The Reclamation ERA

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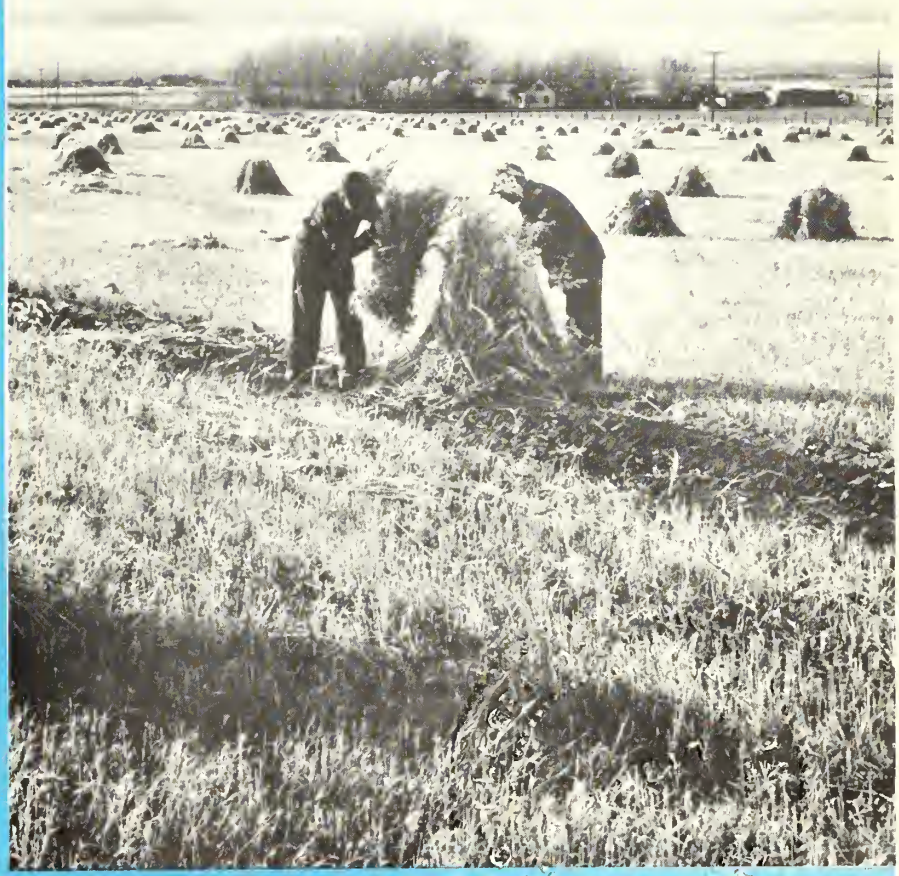

IN THIS ISSUE:

January 1953

Volume 39, No. 1

The Reclamation ERA

35 Years Ago In The Era

New Years Greeting to the Reclamatian Farmers

The water and the thirsty land have been united. On more than a million acres of reclaimed land you have established your homes and have subdued the desert to profitable agriculture with an annual harvest valued at $50,000,000. During the past year, in response to the President's appeal to the farmers for increased food production, you added 200,000 acres to the cultivated area of your farms, and are now preparing for greater efforts in 1918. Your contributions to the Liberty Loan have been generous. Patriotically and loyally you have given your sons to the cause of democracy.

The Nation has reason to be profoundly grateful for the abundant evidence on every hand of enduring love and service for the cause of liberty. May the New Year bring you a full measure of health and prosperity.

(From the cover illustration of the January 1918 issue of the RECLAMATION RECORD, predecessor to the RECLAMATION ERA.)

OUR FRONT COVER—PEACE AND PROSPERITY are portrayed in this scene of the Sun River project in Montana. Oats and barley are being stacked on Ray T. Ramsey's irrigated farm. Photo by Donald H. Demarest, former Region 6 photographer.

OUR BACK COVER is based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners Kittredge and Coolidge.

DESIGN AND ILLUSTRATIONS by Graphics Section, Bureau of Reclamation, Washington, D. C.

R. F. Sadler, Editor

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In this issue . . .

RECLAMATION PLACE NAMES IN THIS ISSUE

THE WHITE DEPOSIT marking the water line in Lake Mead, consisting chiefly of silica and calcium carbonate, represents a small part of the 10,000,000 tons of material precipitated in the lake, offsetting to some extent the salt concentrated in the water.

IRRIGATION AND WATER QUALITY

by C. S. HOWARD, Regional Chemist

Quality of Water Branch, U. S. Geological Survey

Salt Lake City, Utah

Part 1—How dissolved solids increase in irrigation water

EDITOR'S NOTE: The Bureau of Reclamation has always been deeply concerned with the quality of water used for, and resulting from, irrigation.

Before a project is constructed, Bureau technicians study the chemistry of existing water supplies and forecast future changes which may occur under irrigation.

If there appear to be problems which cannot be corrected, the project may not be built. If remedial measures should be taken, these are recommended and put into effect.

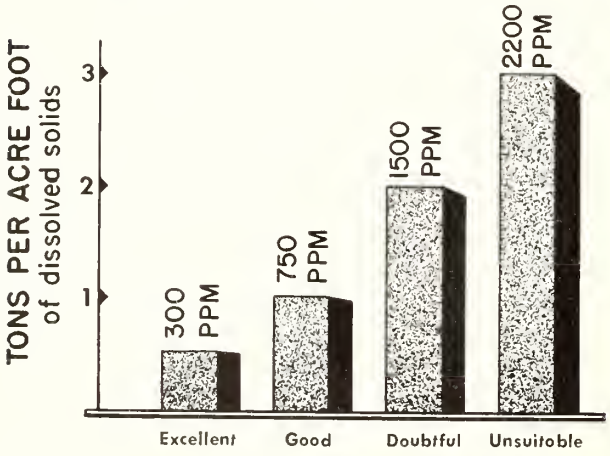
A "Watchdog" program, using the facilities of more than a hundred selected gaging stations over the West, has recently been organized. Known as the "Water Quality Network," this activity is designed to keep tabs on the quality of water and changes which occur in the rivers and streams of the West. The Bureau of Reclamation is cooperating in this program which is under the direction of the Federal Inter-Agency River Basin Committee and operated by United States Department of the Interior's Geological Survey. Other Federal agencies cooperating in the program include the United States Department of Agriculture, Federal Security Agency's Public Health Service and the Department of the Army's Corps of Engineers.

DO YOU HAVE WATER-LOGGED AREAS and alkali spots on your land? How about similar areas and spots on your neighbor's land upstream? The way water is used upstream from your intake, with the possible exception of that used for power development and navigation, has a great deal to do with the quality of water which reaches your farm. The way you use water on your own farm for irrigation may change the water quality in relatively short stretches of a river. Growing plants require large quantities of water, but as they grow they do not use much of the minerals which are dissolved and carried in irrigation water. As a result, these dissolved solids become concentrated in the water which remains unused. Drainage from unimproved and irrigated areas (as desirable as this may be for the lands drained) will increase

TOO MUCH SALT in the soil prevents barley growth. *Photograph courtesy of the United States Department of Agriculture, United States Regional Salinity Laboratory, Riverside, Calif.*

the dissolved solids content of the stream into which these drainage waters flow.

Water undergoes many chemical changes as it flows along, soaks into the ground, comes into contact with minerals in the soil and dissolves them. All natural waters contain quantities of dissolved solids ranging from the small quantities found in most mountain waters to appreciable quantities found in waters from some wells, rivers, and lakes. Normally the quantities of dissolved solids in natural waters are so small, however, that for convenience these quantities are reported in units of parts per million, that is, the number of pounds of soluble material in a million pounds of water. For irrigation waters the quantities of soluble material are reported as tons per acre-foot of water. As an example of the quantities with which we are concerned it might be said that the Colorado River below Hoover Dam has an average dissolved solids content of 650 parts per million which, expressed in tons per acre-foot, will be 0.88. Another method of expressing this concentration would be to consider that a 55-gallon barrel of clear Colorado River water when evaporated to dryness would leave a residue weighing less than 5 ounces.



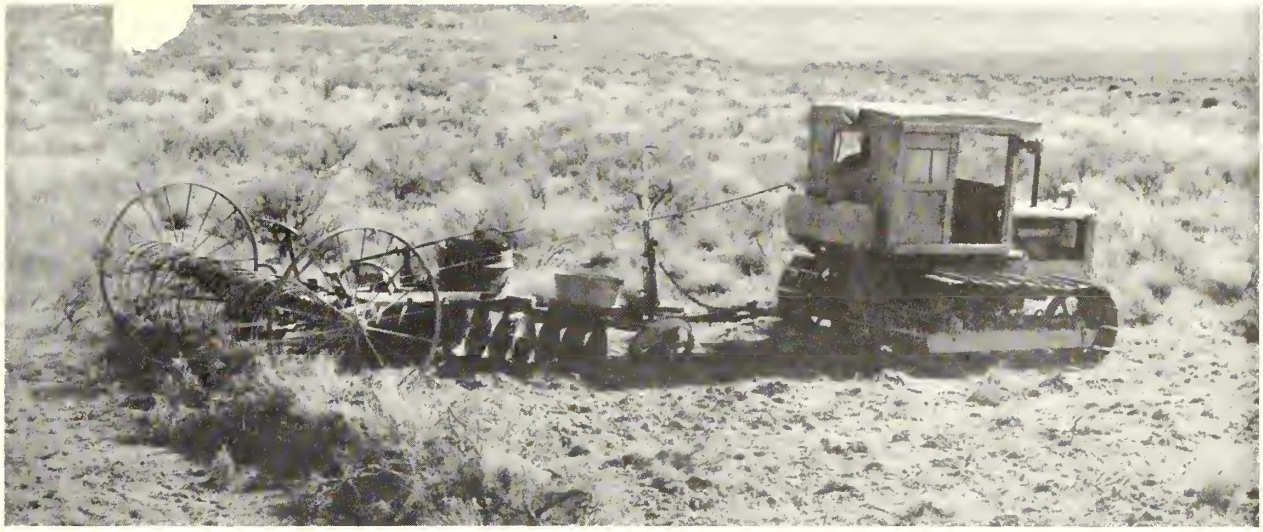
HOW MUCH SOLUBLE SALT CAN MOST IRRIGATED CROPS STAND? If your irrigation water contains ½ ton of dissolved solids per acre-foot or 300 parts per million), the quality of water is considered "excellent." The chart indicates the progressive standards for water quality considered "good," "doubtful," and "unsuitable." *Chart drawn by Graphics Section, Washington, D. C., based upon information contained in United States Department of Agriculture Circular 784.*

Irrigation water is obtained from both surface and underground sources. Surface water is often taken directly from streams, but as the stream flow fluctuates from season to season and is usually lowest when irrigators need water the most, it is desirable to have storage reservoirs from which water can be drawn as needed. Supplies from underground sources are in effect drawing from reservoirs, and when the rate of use from underground sources exceeds the rate of recharge of those reservoirs a water shortage results. Water shortages are troublesome enough, but there is another thing to consider. If you continually pump or use more water than is usually stored beneath the surface, you may start to draw water of a less desirable quality into the underground reservoir.

During storage of surface waters some water is lost through evaporation. For large reservoirs in dry climates this may amount to appreciable volumes of water. The dissolved solids left behind as the water evaporates become part of the dissolved solids already contained in the stored water.

Many reservoirs have been constructed, particularly in the Southwest, in areas where there are

(Please turn to page 4)



SUBDUING SAGEBRUSH is not too tough when a Wheatland disk plow rig is used. Here, a defiant stand of sagebrush on the Roza Division of the Yakima project has been transformed into a clean field. *Photo by Stan Rasmussen, Region 1 photographer.*

THE DISK PLOW RIG:
A Handy Weapon in Removing Sagebrush

based on information supplied by
FRANK WEBSTER, County Agent, Prosser, Wash.

SAGEBRUSH CLEARING IS ONE OF THE DIRTIEST, peskiest jobs in Reclamation. Farmers are always on the lookout for an easy, and—most important—a cheap method of doing the job. In many parts of the West, particularly on the Roza Division of Washington's Yakima project, the Wheatland disk plow rig has come into popularity as a weapon against the sagebrush because it usually offers time-saving and cost advantages.

Basically the rig consists of a Wheatland disk plow, hauled by a tractor and towing an ordinary dump rake. The plow slices about two to three inches underground, cutting the crown of the sage off the root. The rake collects the sagebrush into windrows when tripped by the operator on the tractor.

A crawler tractor is best for hauling the rig because, unlike a wheel tractor, it doesn't slip and dig itself in on the steeper slopes. The added power of the crawler tractor comes in especially handy when the brush and bunch grass are particularly heavy. Large rubber-tired farm tractors have been used successfully, however. Often the tractor is equipped with lights for night work.

The Wheatland disk plow used most often on the Roza has 20-inch diameter blades, although a plow with bigger blades works even more effectively. The disks should be kept sharp and set to cut the required 2 to 3 inches underground. If the plow is not heavy enough to cut the desired depths, it can be weighted. Setting the disks too shallow results in leaving some of the brush uncut and leads to the extra expense of going over the area a second time or cutting the sage loose by hand. If the disks are too deep, they will plow much of the dirt over the sage, making it impossible for the rake to pick up the sage cleanly.

Once cut, the brush is no longer a problem. The plant is killed when the crown is cut from the root and the roots are then easily cut by plows or other tillage implements. An easy victim of decay, the root usually disappears completely in two or three irrigation seasons.

The rake used is an ordinary hay dump rake with a stub tongue attached so that it follows obediently behind the plow. A rope is fastened to the dump pedal at one end of the rake and then strung to a convenient place in the cab of the tractor, where the operator can trip the rake by "finger tip" control of the rope. The windrows

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left behind the rig are usually small unless someone rides the rake and holds down the teeth. A disadvantage in weighting the teeth, however, is that it sometimes results in raking a lot of soil into the windrows.

It is wise to point the rows downwind so that later they can be burned quickly and neatly. Most of the Roza farmers found it helpful to cross-rake the area after burning since some of the more wily sage always manages to work free of the rake teeth and sit defiantly out of the windrows beyond the burning area.

Where brush and trash are very heavy and the tractor does not have enough power to handle both the disk and the rake, the clearing can be done in two operations. Generally the rig works best in small, sparse sagebrush, but it is also reported that the Wheatland disk plow rig has worked quite well even in thick, waist-high brush on the Roza. The crawler batters down much of the brush as it passes over, making it easier for the disk to get at the crowns.

Because it can often clean up the sagebrush in one fairly easy operation, the disk plow-rake method cuts costs considerably. Costs on the Roza range from $8 per acre to as high as $15 per acre, depending on thickness of the sage and other factors.

The disk plow and the crawler tractor, best adapted for hauling the rig, are usually to be found anywhere in the vicinity of new irrigation, where clearing and leveling is underway. ###

Irrigation and Water Quality

(Continued from page 2)

large quantities of soluable salts in and around the reservoir site. As water rises in these reservoirs the soluble material is leached and the dissolved salts are added to the concentration of minerals in the stored water. Computations for Lake Mead have shown gains in dissolved solids due to solution and evaporation of about 20 million tons of material in the first 14 years of operation. The more easily soluble salts have now been leached and it is likely that the rate of increase in mineral matter from solution will decline in the next few years.

Another process takes place during storage which tends to offset to some extent the increase due to evaporation and solution. This is the precipitation of certain constituents of the water, chiefly calcium carbonate and silica. These minerals settle and do not become part of the dissolved solids in the water. Computations made for Lake Mead indicate that more than ten million tons of these constituents were precipitated during the first 14 years of storage. The white deposit marking the water line in Lake Mead, consisting chiefly of silica and calcium carbonate, represents a small part of the material precipitated in this lake.

The quantity of water used in growth processes varies, of course, for different types of plants, but the annual quantity used averages more than 2.5 feet for each acre of cropped land. Plants use little of the mineral matter of the irrigation water and as a result much of the dissolved material is left in the soil solution or in the soil. Natural or artificial drains must be available to carry these solids out of the root zone to avoid a toxic accumulation of soluble solids. For an irrigation water like the Colorado River below Hoover Dam the annual use of 2.5 acre-feet of water will make available more than 2 tons of soluble salts per acre of irrigated land. Many irrigation waters have more than this quantity of soluble salts so that successful irrigation requires the drainage of some of the water and its increased soluble solids load out of the irrigated area. There is additional increase in dissolved solids content through the use of water by plants growing around a reservoir.

This discussion has shown how large quantities of soluble material may be added to the salt load of a stream through changes during storage and through irrigation practices. Casual observations in any irrigated area will show some deleterious effects of irrigation as evidenced by the presence of water-logged areas or deposits of salts. In the next article information will be presented concerning the quality of waters in various irrigated areas.

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HAVE YOU CHANGED YOUR ADDRESS LATELY? GOING TO MOVE SOON?

Let us know immediately so we can change our mailing list—it takes time, you know.

We'll do our best to deliver the Reclamation Era at your door, but we have to know where it is.

Reclamation's Hall of Fame

Nomination No. 15

CLIFFORD H. STONE

—The man with a mission

by JOHN GEOFFREY WILL
Secretary and General Counsel
Upper Colorado River Commission

"EVERY EXTRAORDINARY MAN," said Goethe, "has a certain mission to accomplish." Yet there was nothing in his early youth at Powderhorn, Colo., in the magnificent Gunnison River Valley, from which it might have been foretold that Clifford H. Stone was the possessor of a peculiar genius that was to ornament his later years; that he did indeed, have a mission; and that he would complete the same.

Had we been able to read the signs, the first indication of his extraordinary elements might have been noted when the people of Gunnison elected him County Judge. He was only 24 years of age, probably the youngest County Judge ever elected in Colorado, and had had only 1 year of study at the Law School of the University of Colorado (1911–12). Forever thereafter, he was to be called "Judge Stone."

He served 8 years as County Judge of Gunnison County, managing to perform his duties while serving with the Army and continuing his law studies. Ironically enough, he tried to enlist, was refused on account of his poor eyesight, and was subsequently drafted into the Infantry in August 1918, where again his nearsightedness was noted and he was assigned to limited service with his local draft board, being honorably discharged 1 year later. In the meantime, he managed to resume his law course at the University of Colorado, passed the Colorado Bar exam in December 1920 with the highest mark accorded to anyone in that examination, and obtained the degree of Bachelor of Laws in June 1921. He found time also to publish the Gunnison "News-Champion" for a brief period, at one time having wavered between a law and journalism career.

Beginning in June of 1921, Judge Stone engaged in general law practice in Gunnison, carrying on also his duties as County Judge for awhile. During the period between the completion of his 8 years on the Bench and his election to the Colorado General Assembly, he served at various times as County Attorney and Deputy District Attorney. In this latter capacity, he served for 12 years under both Republican and Democratic District Attorneys. It was apparent, even then, as it continued to be throughout his career, that he would not let partisan politics interfere with duty. During the period of his general practice in Gunnison he gained that experience in mining and water law, the former providing the foundation of the latter, which stood him in such good stead in later years.

The people of Gunnison, Sagauche, and Hinsdale counties had, in 1936, elected Judge Stone to a term in Colorado's General Assembly. He never ran for reelection; for his mission came upon him. As a legislator he worked hard to lay the foundation for the wise and imaginative handling of Colorado's internecine water wars. This foundation is technically referred to as "AN ACT—*Relating to the Waters of the State of Colorado, Providing for the Control, Protection, and Development Thereof, and Making an Appropriation Therefor.*" It became law in June of 1937. It has been amended from time to time. Other

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States have produced more or less faithful imitations of it. Its principal purpose was to create the Colorado Water Conservation Board with a membership representative of the State's various river drainage areas, that is to say: the Rio Grande, the North Platte, the Arkansas, the South Platte, the Yampa-White, the Colorado, the Gunnison, Uncompahgre, and the San Miguel-Dolores-San Juan areas. Judge Stone became the first director of that Board, serving in that capacity, through Democratic and Republican administrations, until his death on October 21, 1952.

Protection of States' Rights

The mission to which he was to devote his life, was a peaceful mission that would, in due course, produce great works for Colorado and the West. He wanted peace within Colorado; but he would not to that end sacrifice the destiny of any area. He wanted peace among Colorado and her neighboring States, all dependent to some extent on common river systems; but he would not to that end sacrifice Colorado's interests. Nor would he (and this is revealing) knowingly permit the negotiators of another State unwittingly to yield. He wanted to be sure that they were as fully possessed as he of the facts pertinent to the matter that was the subject of negotiation. He wanted an end to conflict between the States and the Federal Government; but he would not for that sacrifice the integrity of State water laws. He believed that the Western States could achieve great works for the development, conservation and utilization of their water resources by assisting one another and by presenting a united front to the world and, particularly, to Washington. He believed profoundly in the Federal Reclamation program. He would seek always to work with the Bureau of Reclamation and the Army Engineers and to persuade others to do the same. He had no use for those who, holding a brief for some particular interest, worked to subvert the reclamation movement.

Such was the mission set for himself by this extraordinary man. Having become convinced that the best possible means for the settlement of inter-State disputes relating to water lay in compacts, he became the protagonist of that means. The Rio Grande Compact, the Republican River Compact, the Costilla Compact, the Arkansas River Compact and the Upper Colorado River Basin Compact, and others all testify to his effectiveness in the settlement of quarrels or incipient quarrels of which the Supreme Court would, in any event, have been reluctant to take jurisdiction. He was working at the time of his death toward a Missouri River Basin compact and toward some such arrangement on the Arkansas-Red-and-White.

Judge Stone did not always agree with all the agencies with which he cooperated, nor was he blindly inflexible in his opinions. This was demonstrated during his violent disagreement with the Bureau of Reclamation on the policy and practice of using revenues from the Federal Government's investment in the power facilities of Reclamation projects to help pay the cost of irrigation features. The judge drafted a bill to outlaw the practice and waged several battles before congressional committees. The bill was never enacted, and the judge later became convinced of the benefits and legality of the policy in question. He had the courage, rarely found today in public figures, to let his change of mind be known as widely as he had theretofore aired his prior opinion.

Projects for Peace

Early in the year 1951, Judge Stone made an appeal before the House Committee on Interior and Insular Affairs, in behalf of the 17 Western States. Having noted that budgetary conditions might become such, from time to time, as to indicate the need for some retrenchment of domestic expenditures, including expenditures for Reclamation; having asserted that the 17 Western States could and would do their patriotic bit to bear that part of, as he called it, "the bitter fruit of man's apparent lack of ability to wage peace as well as war," he said: ". . . the conclusion is inescapable that you must also build a shelf of authorized projects, both large and small, that can be undertaken during periods of reduced stress. You should have these projects ready to go. . . . In other words we should plan now for peace and, to the fullest practicable extent, we should build now for peace . . ."

On another occasion he exploded before the Secretary of the Interior the myth oft repeated that, once a national monument has been created, it may never ever be considered for uses broader and more beneficial than those originally pro-

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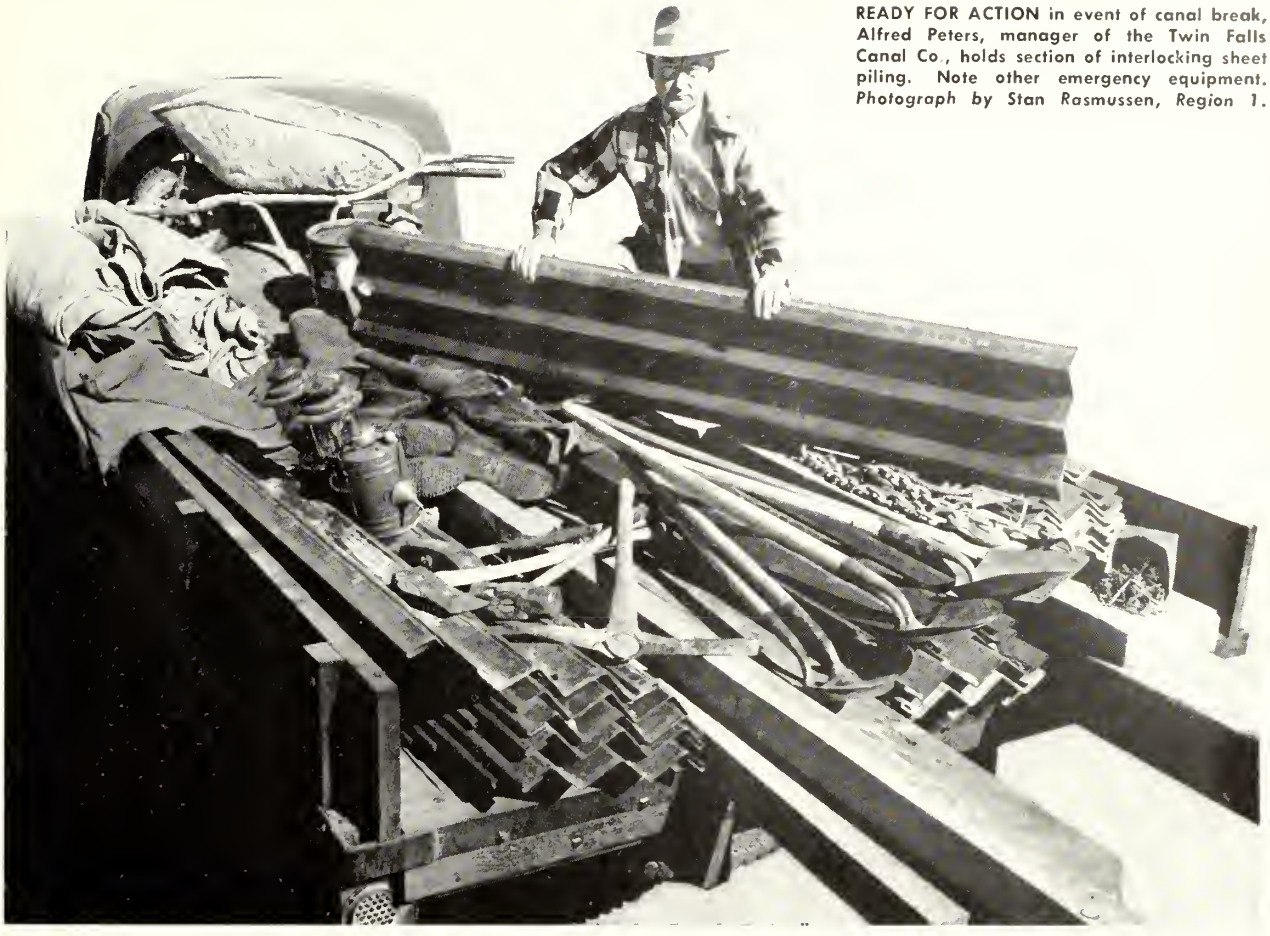

READY FOR ACTION in event of canal break, Alfred Peters, manager of the Twin Falls Canal Co., holds section of interlocking sheet piling. Note other emergency equipment. *Photograph by Stan Rasmussen, Region 1.*

In Canal Breaks—SPEED'S THE THING

by DICK LARSEN

Region 1 Headquarters, Boise, Idaho

"A BREAK IN THE MAIN CANAL," rasped the excited telephone voice.

In his office in Twin Falls, Idaho, Alfred Peters fired quick questions. This break, he learned, was a big one. Carrying 3,600 cubic feet of water per second, the giant canal had burst through its bank near Murtaugh Lake, 28 miles from town.

When a canal bank gives way it can mean disaster. But Peters, manager of the Twin Falls Canal Co., a privately built, owned and operated irrigation project, had geared his organization to quick action. Within seconds, an emergency truck, driven by Dave Remaly, roared out of the company yard. Peters, in his own car, dashed out to pick up help. In 20 minutes the truck, its radiator boiling, reached the scene of the break. Water was pouring through a 20-foot gap in the canal bank. At almost the same moment Peters and a crew of men arrived.

The first telephone call had been made at 10 a. m. By noon the break was checked and the water was back where it belonged. What could have been a disaster turned out to be no more than a stiff, 2-hours' workout for the crew. They had successfully unleashed a new weapon against the canal break—the emergency truck.

Just a few weeks earlier, it had been loaded with a hodgepodge of gear necessary for such an emergency and had been put on a 24-hour-a-day standby. When it was needed, it was ready to roll.

Key item among the truck's paraphernalia is a collection of $^{3}/_{16}$-inch steel sheet piling, in 4-, 5-, and 10-foot lengths. The sheets, 14 inches wide, with interlocking edges, are sunk one at a time directly across the break, forming a neat cofferdam

STOP GAP WALL made of sheet piling closes canal break. Note lightness of metal as Dave Remaly in the photo at right passes one to Pete Gillespie on the canal bank. *Photo above, courtesy of the Twin Falls TIMES-NEWS; photo at right by Stan Rasmussen.*

to keep the water within its banks and to permit easy permanent filling. The individual sheets are light enough for two men to handle easily and are driven into place by heavy 12-pound hammers and a 50-pound weight which is carried aboard the truck. The weight is placed atop the sheet piling and then driven down with the hammers. A hole near the top of each piling section permits handling them with a hay hook and is also used to lift them out of the bank later. Commonly used for cofferdams and similar devices, the sheet piling is available from many construction equipment firms. As a bonus benefit, the piling comes in handy in many nonemergency jobs, such as dewatering small areas in front of turnouts for repair of the gates.

Other important items among the truck's collection are a number of 3 x 12 timbers, in about 12-foot lengths, used to form an emergency walkway across the escaping water. One board is tossed out from each side of the break, providing a place for workers to stand while driving the piling. If necessary, 4 x 4's are hauled off the truck to serve as supports for the walkway.

Also aboard the emergency vehicle are rolls of canvas sheeting and bales of burlap bags to be used as bank sealers, and such important miscellany as picks and shovels, a bucket and hammer and nails. Chains and hooks are available for handling the piling and removing it when its work is done. The chains are also available for possible use in case the truck gets stuck. For night work the truck carries a stock of kerosene lamps and—as a neat added touch of prevention—a can of lamp fuel. Of course, the familiar rubber boots are also handy.

The truck happens to be a unique feature of the canal company's operation. The organization is alert in other ways. Manager Peters always has handy in his Twin Falls office a roster showing just where the 3- to 8-man repair and maintenance crews are working at any given time. If a break comes on any part of the company's 202,000-acre tract, the truck is on its way while a car races to the crew nearest the break to recruit manpower. Dave Remaly is ready to hop into the cab of the truck any time of the day or night. Nearly everyone subject to night calls carries in his own car a high-powered searchlight which can be plugged into the dashboard lighter socket.

The Murtaugh break was the biggest action in which the truck participated in its first season of operation in 1952. There were other smaller breaks, any one of which could have become major. The amount of damage which the truck has prevented is inestimable, Peters points out. A small break speedily checked might have otherwise grown into a big one, sending floodwaters racing through valuable farmlands. Quick installation of the sheet piling in the Murtaugh break not only checked the flooding but also made it unnecessary to turn off the water in the canal. That prevented

the farmers' irrigation water from being cut off, which often does more dollar damage than flooding. The break happened to be on the uphill bank where the canal crosses relatively flat country. The sheet piling is best adapted to repair of breaks in fairly low canals in flat country where the escaping water does not have a big drop and high velocity.

"The key to effectively handling canal breaks is speed", Peters says. "It's just like a fire. Fire engines are all ready at any moment an emergency strikes. That's what gave us the idea of having our truck all loaded and ready to go at any moment. Speed's the thing."

And speed is what the Twin Falls company has. But even now it is considering installing radio contact with its field crews to further expedite the operation. The Twin Falls company's concept of speed and its poised 2-ton truck and hodgepodge load may show the way for other water user groups facing the constant threat of the canal break.

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CLIFFORD H. STONE

(Continued from page 6)

posed to be served. He said that adherence to such absurd doctrine "is contrary to the recognized principle of integrated resource development in the maximum attainable degree for all purposes." Such doctrine, he went on to say: "assumes that, when a national monument is once established, every phase of the pattern of river basin development has been explored with unerring skill and with a clear knowledge of future economic conditions." "We all know," he said, "that national monuments have not been established in that way."

He was principally honored, not only in Colorado, but throughout the West by being saddled with jobs, the end objective of each of which was to achieve the development and protection of Western water resources. He had been regional director of the National Resources Planning Board; he had served, by appointment of the Secretary of the Interior, as mediator in a dispute involving certain Arizona irrigation districts; he was chairman of the Basin States Committee and, as such, he played an important role in securing ratification of the Mexican Water Treaty; he had been a vice president of the National Reclamation Association and was a director of that Association for many years. In that capacity, he could be found always actively engaged with those members of the Association who favored continued encouragement for development of the country's water resources. He was a member of the Arkansas River Compact Commission; a member and vice chairman of the Upper Colorado River Commission. He had been designated by the Council of State Governments as a member of a committee of three to draft a proposed compact for the Missouri Basin States. It is impossible, without unduly lengthening this article, to list all of the capacities in which he served his fellow man.

In May of 1952, at ceremonies under the auspices of the University of Colorado chapter, there was conferred upon him honorary membership in the Order of the Coif, a legal fraternity, active membership in which is based upon scholarship. So far as I can determine, this honor and membership has been conferred in Colorado upon only four other men. I remember how deeply moved he was at the recognition thus accorded his public service. An honor which others had perhaps accepted with equanimity seemed to come almost as a surprise to him who had done most to deserve it.

He whose name was a byword in the West and elsewhere, the man thus honored by his fellow men, was charmingly careless for himself. Devotion, consecration, selflessness—these attributes he had in fullest measure. His accomplishments testify to that. The lost hat and coats forgotten in restaurants and meeting halls; the cigarette ashes on his suit at the end of the day—these homely things too are suggestive of a mind at work for others.

The man with a mission has gone forward in the service of Providence. Mission accomplished? Yes—Colorado and the other Western States will provide proof of that accomplishment by reaching prompt agreement within and among them upon questions to the settlement of which he gave his mind, his heart and his life.

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Errata Note on "Columbia Basin's First Harvest"

In the article "Columbia Basin's First Harvest" which appeared in the November issue of the RECLAMATION ERA, the following corrections were received too late to reach the printer: On page 263, paragraph 2, the correct name is Percy A. Kelly, rather than Paul, and in paragraph 2, Quincy should be changed to Winchester in referring to the $600-an-acre onion crop. On page 264, column 2, paragraph 2, change the acreage figure from 59,558 to 65,692.

ASSEMBLY LINE production methods at left bring a neat profit to Lindo Starr, Orland project farmer. At lower left, a handful of 3-month-old earthworms, ready for shipment to all parts of the country for a variety of purposes: bait, fertilizer, and research.

ORLAND'S FERTILIZER FACTORY

by BRUCE B. BARNUM, Agricultural Aid
Sacramento Valley District, Chico, Calif., Region 2

A BRAND NEW CROP is being grown on the Orland reclamation project in northern California, where a variety of produce from grains to citrus fruits already is the pride of the district. It is the lowly earthworm, raised in commercial quantities on the farm of Lindo Starr at the east end of the 20,000-acre irrigation development.

"Not only do the worms turn a neat profit back to the owner, but they turn back to the soil the most perfect natural fertilizer yet discovered," the enthusiastic Mr. Starr said.

"I'm a relative newcomer to this business of earthworm raising," Mr. Starr said, "just finishing up our second year here, but I had been doing a lot of reading and thinking about it."

Mr. Starr admitted that most of his production goes for sports consumption as bait at the present time, but that he is encouraged by the increasing demand for breeding stock. In addition there is a need for worms by laboratories, researchers, and others who are interested in organic gardening.

Although worm production is a business more or less unique at this time, it resembles some factories in that an assembly line is necessary. It takes the form of a long wooden counter, where spot checks of each shipment are made to determine proper count, size, and food and moisture content of the packing material in each box. The small packing boxes are made from lumber scraps.

"The peat moss we use for packing material must have sufficient food and moisture to last until the shipment arrives at its destination," Mr. Starr pointed out. "Once, on a very hot day I received a call for help from the postmaster. Heat had forced the worms to escape through the air holes, and they were all over the postoffice."

Does a worm farm pay? You bet it does. During a peak month last summer the Starr enterprise grossed $6,000 from worm shipments alone. Added to this are such items as organic fertilizer and gardening gadgets.

"There are lots of angles to this business," the Orland farmer said. "For instance many people have asked me how the worms are kept confined in the beds without high sides or concrete bottoms. It's simple. Just keep them comfortable where they are and there won't be any wandering worms.

"They seldom stray far from food, darkness, and moisture, and if by chance they do go wandering, we just turn on the lights and run them back to their corral. They have no eyes, but are highly sensitive to light nevertheless."

Mr. Starr said that the food problem in raising earthworms is an easy one, and that table food

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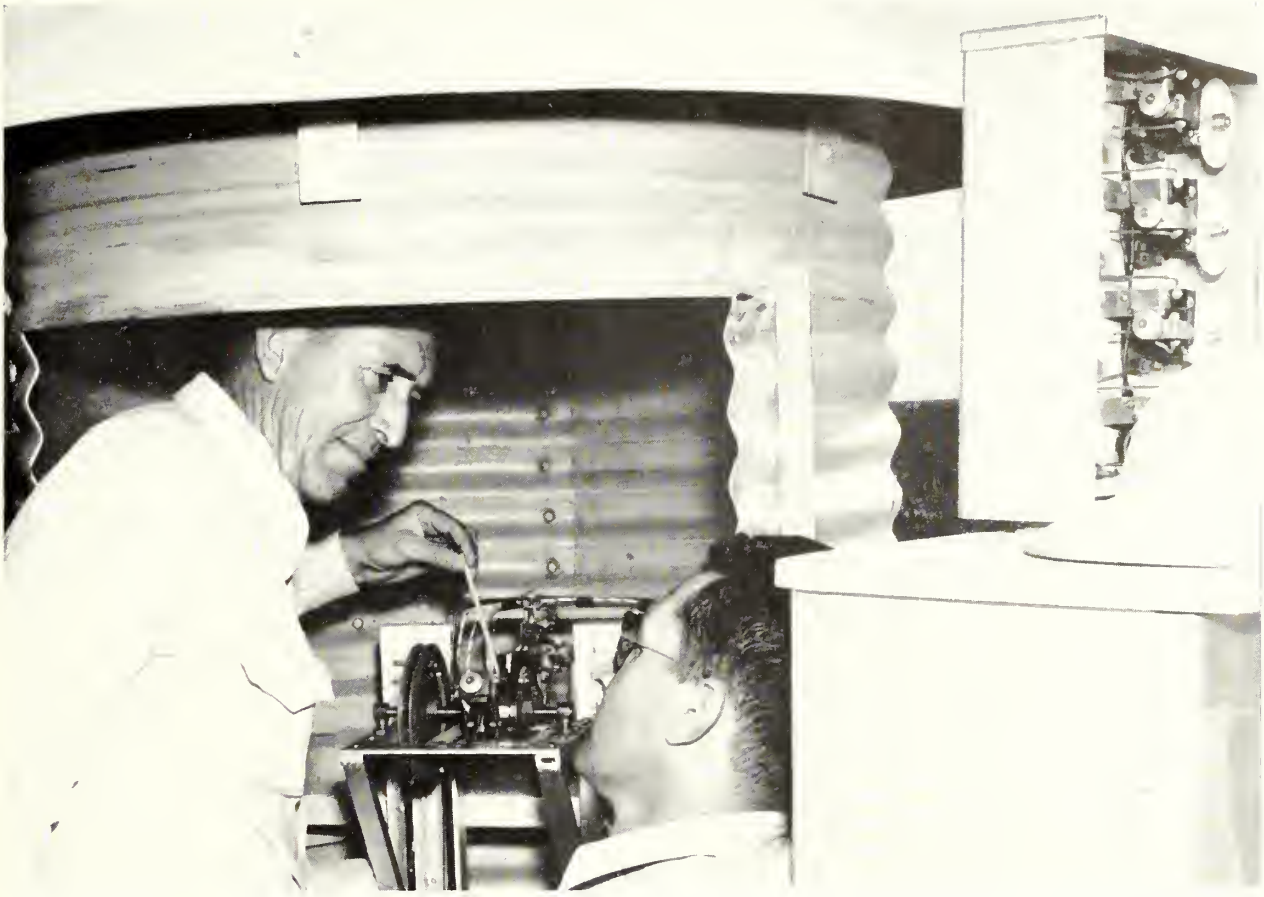


"THE LITTLE MAN" at the White River check of the Friant-Kern canal is the automatic gadget to which Harry E. VanEvery, operations maintenance chief, is pointing, explaining its work to Edgar K. Williams, assistant canal superintendent at Delano.

Friant-Kern's Automatic Gate Tender

How the "Little Man" Tames a Big Canal

by JACKSON T. CARLE,

San Joaquin Valley District, Fresno, Calif., Region 2

EDITOR'S NOTE: As stated in this article, several automatic gate operating devices exist and are in use in Bureau of Reclamation installations, and descriptions of them will be published in future issues of the RECLAMATION ERA. However, this particular gadget was designed to improve the service to water users in a specific area where unusual problems were encountered.

"THAT LITTLE MAN is the best hand I've got! Always does what I tell him—and no questions," says Manuel Aaron.

Aaron is operation and maintenance superintendent of the Delano section of the big Friant-Kern Canal, a key unit of the Central Valley project in California.

The "Little Man" is an automatic device developed by the Operations Division staff of the San Joaquin Valley District, Region 2, which controls the water level in the canal. It has been in experimental operation with remarkable success at the White River check of Friant-Kern Canal, during the entire 1952 irrigation season. Prior to 1952, it was necessary to station a man at this check gate to operate the gates as required on a 24-hour 7-day-a-week basis in order to maintain reasonably constant canal levels.

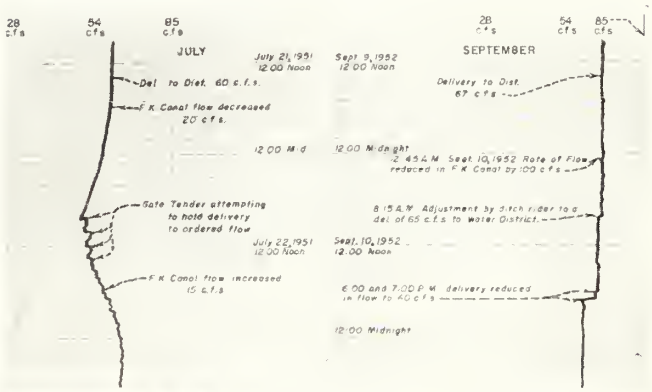
With bugs ironed out through a season of use at this location, bureau shops at Friant Dam are building improved models of the device. A "Little Man" has recently been installed at the Kaweah check on Friant-Kern Canal, another has been

sent to the Delta District for experimental use on the Delta-Mendota Canal. With slight modifications, the device is believed capable of a variety of automatic operations where varying flows in main canals make it difficult to maintain steady delivery into laterals. Bureau engineers think the device will solve some of the most difficult problems of irrigation system operation.

Like most inventions, the idea for the "Little Man" grew out of a need. Friant-Kern Canal, which has a designed capacity of 5,000 cubic feet per second, is operated through a series of motor-driven radial gate checks, each backing up water through the canal reach above it. Twenty irrigation districts and water user groups take service from the canal through numerous turnouts along the leveled water stretches, which form a series of steps from Friant Dam to Kern River, 153 miles to the south. Water orders from the districts determine the quantity released into the canal at Friant. The release varies from day to day, for it depends not only on the total orders, but also on the length of time, up to 3 days, for the water to reach a particular turnout.

With turnout gates or valves adjusted to provide the flow of water ordered by each irrigation district, the water level in each reach of the canal must be maintained at a nearly constant level, or flow through the turnout will vary correspondingly and deliveries will not reflect district orders. More important, it often upsets the entire irrigation setup on the water users' lateral or pipeline as individual deliveries must exactly balance total deliveries from the canal. This means that the radial gates at each check must be manipulated so as to maintain a steady water level above them, despite varying quantities of water transported through the canal.

The problem that the Operations Division had



BETTER THAN "PUSH BUTTON" CONTROL.—At far left, an actual record of water deliveries through the White River turnout of Friant-Kern canal to the Delano-Earlimart Irrigation District, showing the variation under "push button" control like that at lower left, demonstrated by Harry E. VanEvery. At immediate left, the record of a comparable operation with the automatic water level regulator. Roy W. Heath has removed the front panel of the radial gate control board to show the four wires connected with the "little man." At right center, a closeup of the synchronous motor unit, installed above the control board at White River. At far right, Harry E. VanEvery (left), Roy W. Health (center), and Edgar K. Williams test the automatic device at White River. The regulator is housed in the corrugated iron well casing at center, the motor unit in the small box on top of the control panel.

SIMILAR TO A THERMOSTAT, the automatic gate tender raises and lowers the gates according to the amount indicated on the turnout settings. Here Glenn C. Beach puts together the float pulley-cam unit at the Bureau shop. This unit is operated by a float.

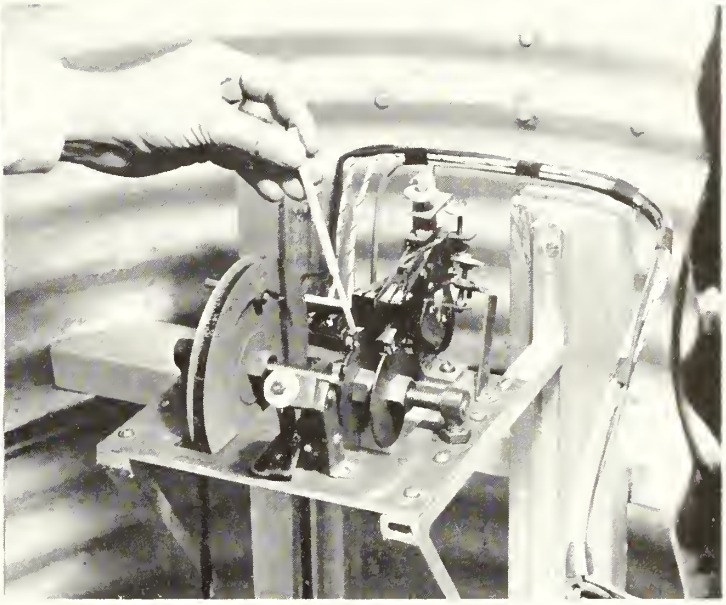


Photo above is a close-up of the unit installed at the top of the well extending into the canal at the White River check, showing wires extending to the relay-synchronous motor unit. The indicator points to a "brake" on the pulley-cam shaft movement.

to solve was how to maintain constant water levels at many of the checks without men available to make frequent adjustments. Gate tenders at checks north and south of White River, for instance, cannot determine the water level above White River without making a special trip. Immediately above the White River check is a large turnout for the Delano-Earlimart Irrigation District. Early operating experience showed a lot of difficulty in keeping the Delano-Earlimart turnout flowing uniformly at the rate ordered by the District. During the 1950 and 1951 irrigating seasons, a gate tender was stationed at White River, housed in a trailer at the canal bank. Even with constant adjustment of check and turnout gates, the season's operating record, shown on charts recording flow through the turnout, was unsatisfactory.

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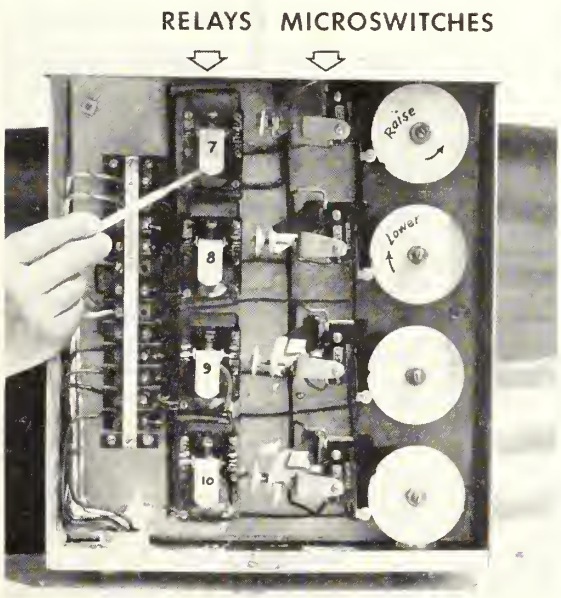

Faced with a limited budget for personnel, as well as the necessity for improving service to the water users, Paul T. Ragle, operations chief for the San Joaquin Valley District, told maintenance chief Harry E. VanEvery, "We've got to do better. What we need is a gadget—something automatic and more sensitive to changes in water level than any gate tender we can station there."

VanEvery searched trade and technical literature for regulating contrivances to answer the White River problem. While he found several automatic operating devices, and got ideas of possible approaches to the problem, he found none that would satisfactorily fill the bill.

"It's up to us," he told Roy W. Heath, technician in charge of the district's mobile radio system, and Glenn C. Beach, electrical maintenance man and general fixer-upper, as he outlined the problem and possible solutions.

With VanEvery contributing ideas, Heath, electrical circuits, and Beach doing the physical tinkering during spare time from regular duties, the "Little Man" emerged ready to try out on the White River check last spring. It worked. The automatic control effectively regulated the canal level through the summer and fall irrigating season. Ditch riders now go to the check and turnout only to change turnout settings to conform with new district orders or to service the recorder which makes a chart of deliveries.

The installed check mechanism at White River consists of two radial gates, each raised or lowered by electrical motors geared to the cable hoist. The gates may be operated by pressing a "raise" or "lower" button on a control board. The automatic device ties into this existing installation without alteration of the mechanism or motor control circuits. The gates still may be adjusted by pressing the buttons, although no need for such adjustment has arisen since the "Little Man" was installed.

Here's how the "Little Man" does the job:

It keeps a finger on the pulse of the canal by a float installed in a corrugated metal stilling well in the middle of the canal immediately above the check gates. Water is admitted to the well by a ½-inch hole through the casing. The small hole insures that the water level inside the well will not fluctuate from ripples or waves on the canal surface, but will respond to actual changes in water level. The float, a standard recorder type, is attached to a tape running over a pulley at the top of the well. The pulley and the shaft upon which it is mounted rotate as the float is raised or lowered. This same shaft carries two eccentric brass wheels, or cams, one to operate as the float goes down, and the other as it goes up.

As these cams rotate in either direction, they operate microswitches used to energize electrical circuits. These circuits could be used directly to turn the motors which raise or lower the check gates, but this causes excessive gate operation and would not take care of changes below the check.

To solve these two problems, Heath designed a second unit, including relays, small clock motors and a second set of microswitches. When the float unit turns the cams, the clock motors go into action. They turn disks with variable notches on the rim. As the notches pass the second set of microswitches, the switches are closed for brief intervals, activating the electric motors which operate the radial check gates. In these brief intervals of operation, the check gates are hoisted or lowered by small amounts. In between the intervals of operation the water level above the gates has time to reflect the changed gate setting. This likewise minimizes the "hunting" action of the gates and reduces the up and down movements required to arrive at the correct gate setting.

At White River, for best results, the notches are set on the disks so that the check gate motors are energized approximately one second out of each minute. In routine operation, the canal level is maintained by operating only one of the two radial gates. A large surge, or continuing raising or lowering of the canal level, brings the second check gate into operation. One of the advantages of the arrangement is that no electrical circuits are in operation unless the device is adjusting the water level.

Efficiency of the "Little Man" in maintaining constant rate of delivery to the Delano-Earlimart Irrigation District, despite varying flow through Friant-Kern Canal, is shown in the accompanying illustration, comparing typical days of operation with a gate tender stationed at the White River check in 1951 and under automatic regulation in 1952.

The automatic control mechanism can hold fluctuations in canal level to within one-fourth inch above or below the level it is set to maintain. It quickly finds the correct gate setting to maintain the proper level, making required final adjustments within 15 minutes under maximum operating changes of flow through the canal. Mean-

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OPEN-AIR SWAP SHOP.—Here we find irrigation operators from all over the Northwest exchanging ideas on how to improve irrigation farming methods and cut costs during the 1952 field tour of the Minidoka project. *Photo by Ted Nelson, Region 1.*

TRADING IDEAS FOR PROFIT

by DICK LARSEN
Region 1 Headquarters, Boise, Idaho

IRRIGATION OPERATORS FROM ALL OVER the Pacific Northwest were in the crowd along the lateral bank, as the new type ditcher demonstrated how it could clean out the 4-foot lateral in one neat pass. Some in the 40-man group nodded their heads. "A nice little rig . . . Come in handy in cleaning out ditches back home."

This was the second annual irrigation operators' field trip sponsored by the Bureau of Reclamation in Region 1. The aim of the affair was to learn irrigation ideas from each other, and that's just what was going on. It was September and the men were on the lands of the Twin Falls Canal Co. on the Minidoka project in Idaho. The day before, they had visited the Big Wood Canal Co. and American Falls Reservoir District No. 2. Before they were through, they would also have toured North Side Canal Co. lands. Everywhere they had been seeing "nice little rigs" and picking up scores of new ideas that would be possible on their own projects. The host project was benefiting, too. If one of the visitors had a better, cheaper way to do a job, he spoke up.

The idea for such field trips was born about 4 years ago, when a few Bureau of Reclamation operators in the Pacific Northwest went on an idea-exchanging inspection tour of the Boise project. The following year no trip was made, but organizer Ted Nelson of the Boise regional office learned that a number of operators of private companies, having heard of the earlier trip, were interested in joining the next one. Neighboring irrigation companies, often faced with identical problems, could probably profit by swapping ideas with each other, Nelson reasoned, and so new plans were laid.

The first trip of private operators and Bureau representatives was made to the Yakima project in September 1951. They inspected the irrigation works, they learned how manpower can be saved in running pumping plants, how aromatic solvents control water weeds and how practical they are on large canals. They learned how the Yakima weir box saves time in water regulation and maintenance. They talked and swapped other ideas.

The 1952 trip attracted even more interest after the success of its predecessor. Irrigation men from the Boise and Minidoka projects of Idaho, the Owyhee, Vale, and Umatilla projects in Oregon and the Columbia Basin and Yakima projects of Washington were along as the group went onto the

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W. C. AUSTIN—Under New Management

by MATTYE WILSON WILLIAMS, Secretary, Altus Chamber of Commerce, Altus, Okla.

EDITOR'S NOTE: The following unsolicited article came as a gratifying although complete surprise to the RECLAMATION ERA. With all due modesty, we have deleted some of the more laudatory remarks by the Secretary of the Chamber of Commerce in favor of publishing more of the factual and historical data which should be of interest to our water user readers. We are proud of the record made by the Bureau of Reclamation employees and are glad they did so well in living up to the motto: "Service is our Business."

FOLLOWING IN THE FOOTSTEPS of other irrigation projects of the Nation, which have been constructed and operated for a time by the Bureau of Reclamation, the Lugert-Altus Irrigation District, representing the water users, assumed responsibility for management of this pioneer irrigation development in Oklahoma on October 1, 1952.

After 6 years of successful operation, during which time new crops have been introduced, production yields in many instances tripled, and numerous new industrial plants have been opened in the city of Altus, the Bureau staff is departing to devote attention to other new project developments throughout the land.

It is with no small amount of regret that Altus and southwestern Oklahoma citizen witness the departure of Bureau of Reclamation employees. Not that there is a doubt of the success of operation under the three-man board of directors, two of whom have been on the board since organization of the district, and the third an equally experienced farmer and business man of the area. Regret comes from losing the Bureau officials and personnel.

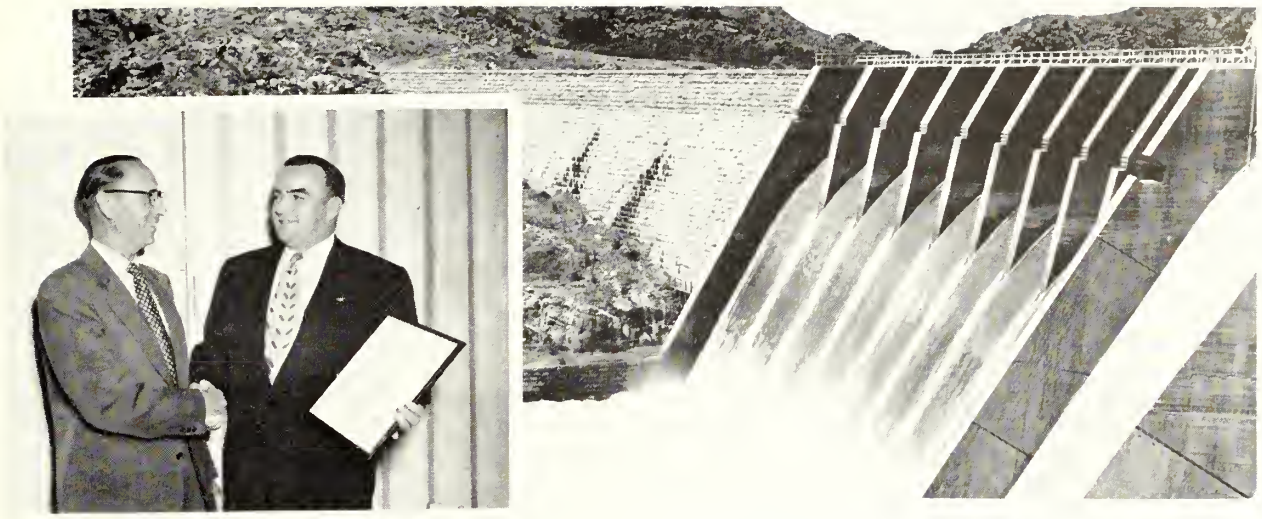
Establishing homes in Altus, assuming responsibilities in the civic, social, religious, and educational growth and development of the city and entire district, Bureau employees became such leaders that their departure, which will be felt by all, creates a distinct vacancy.

When one needed to know the official amount of rainfall, when need arose for a square dance caller, when dignitaries arrived for visits to the city, when farm tours or other agricultural projects were undertaken, when church groups sponsored projects, in fact when anything for the advancement of the area was undertaken, Bureau employees were always willing to help out. So numerous have been the acts of community service performed by the Bureau employees that it would be impossible to list them.

Here, however, to carry out the assignment of initiating and putting into successful operation the pioneer irrigation project in Oklahoma, and one which is serving admirably as an example for

THE NEW MANAGER.—Howell V. Zinn, who on October 1, 1952, took over the job as new manager of the Lugert-Altus Irrigation District, which now handles the affairs of the W. C. Austin project in southwestern Oklahoma, from the former Bureau headquarters at the north edge of Altus.—*Photo by Fred S. Finch, Region 5.*

THE NEW DIRECTORS.—From left to right, R. W. (Bob) Minor, Carthal F. Mock (Chairman), and Clark T. McWhorter. Minor and Mock have been members of the board since the district was organized in 1940. McWhorter was named in August 1952 to succeed Joe B. Zinn. *Photo, courtesy Altus Chamber of Commerce.*



OUTSTANDING SERVICE TO THE COMMUNITY.—James A. Callan, Bureau project engineer, and Chamber of Commerce president R. W. Moore, holding the commemorative plaque. Altus Dam in the background.—*Photo by P. W. George. Inset photo submitted through the courtesy of the Altus Chamber of Commerce.*

future anticipated projects, the officials and staff have accomplished their task well.

The project was initiated about 10 years ago under direction of R. S. Lieurance, now deceased. It was during his tenure that the District signed the repayment contract. Later it was managed by Howard Robbins (now director of Region 5 with headquarters in Amarillo, Tex.), followed by Wayne Byrne, now in Australia, and more recently by James A. Callan. Callan, who joined the Bureau in August 1927, came to Altus in September 1942 from the Buford-Trenton project of the Missouri River at Williston, N. Dak.

Peak employment by the Bureau on the local project occurred in 1941 and 1942 when there was a total of 365. Employment gradually decreased over the years. Now a lone employee, J. S. Savage, reservoir superintendent, resides at the site of the dam at Lake Altus.

In June 1947 water started flowing to a portion of the 48,000-acre project, now served by the district works. Income of the land since that time has increased to where it now shows a ratio of about 3 to 1 in comparison with nonirrigated acreage.

Three bales of cotton per acre, 15 bushels of alfalfa seed per acre from one 20-acre field, and Irish potatoes which grossed approximately $800 per acre are among the outstanding examples of what spreading a water supply during the irrigation season to fill in the gaps left by deficient rainfall actually does on the W. C. Austin project.

Being watched particularly close at this time is a 60-acre lettuce field, the first attempt at growing this vegetable in this area. Prospects are for a $1,000 gross income per acre from this new venture. Lettuce, potatoes, black-eyed peas, soybeans, castor beans, onions, and permanent pastures are among the most promising crops which have been tried since irrigation water has been available to supplement local precipitation.

Two potato-processing plants and a castor-bean plant are industries which are a direct result of the irrigation project.

In preparing for its new duties, the district board appointed Howell V. Zinn of Blair, Okla., as district manager, a position created by the district's increased activities in the project operation.

Zinn, who worked with the Bureau from January 1948 (first in Altus and later with the Missouri River Basin in Nebraska) until 1951, is a native of southwestern Oklahoma. He served from July 1, 1937, until May 20, 1944, as a member of the Jackson County Board of Commissioners.

He will work directly under the supervision of the irrigation board, which includes Carthal F. Mock and R. W. (Bob) Minor, who have been members of the board since its organization, and Clark T. McWhorter, appointed recently to succeed Joe B. Zinn. Mock is now chairman for the board.

In turning over the management and operation of the project to the district, Callan urged the farmers to be ever mindful of the importance of water conservation. ###

BLACK CANYON'S NEW APRON

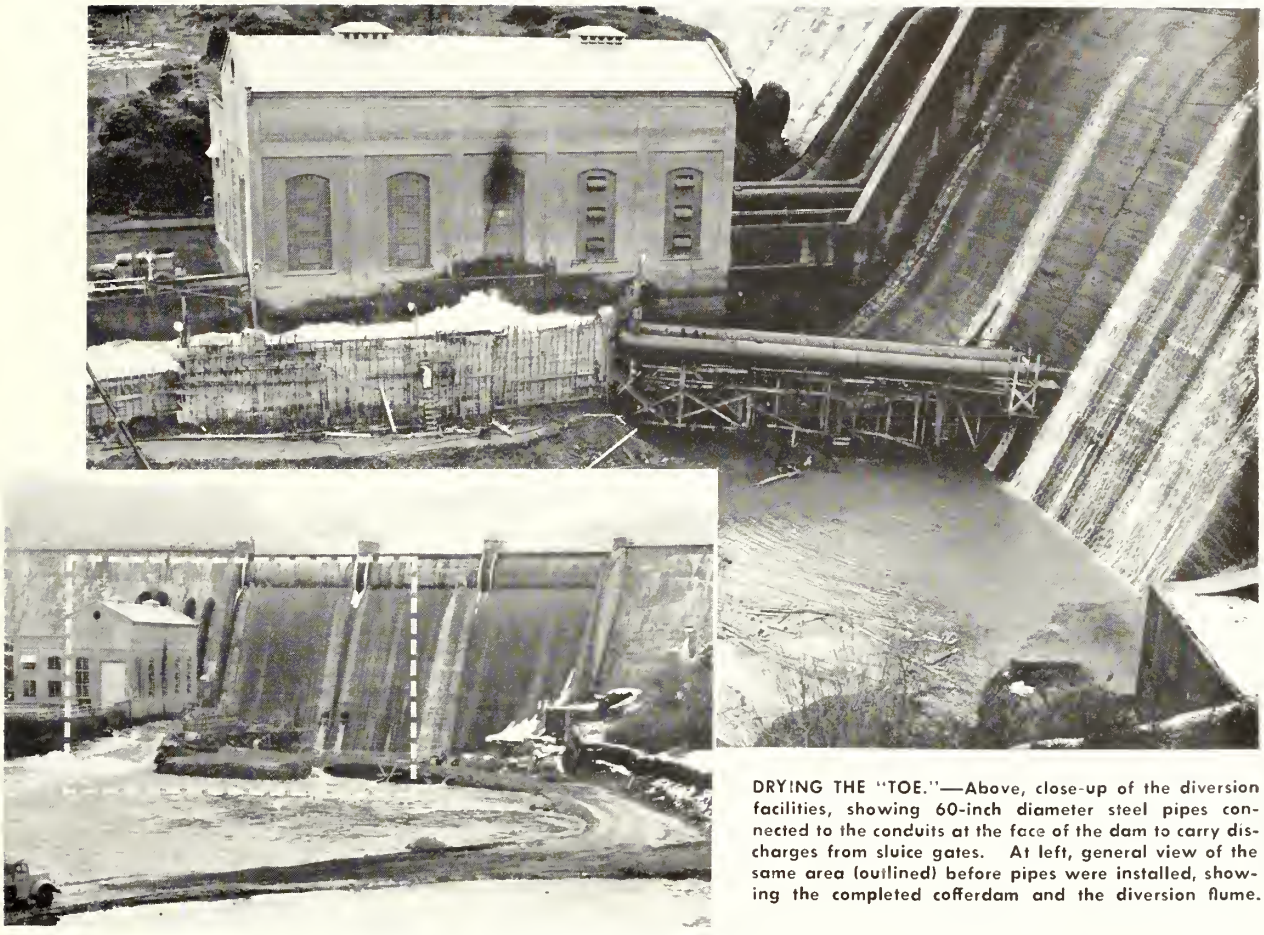
"FACE LIFTING" OPERATION.—Arrows point to apron area. When completed, it contained 5,900 cubic yards of concrete. *All photos for this article by Phil Merritt, Region 1 photographer.*

LAST SPRING A CONSTRUCTION CREW WON a race between time and the Payette River.

After 28 years of serving the 75,000-acre Boise project area, Black Canyon Dam was in urgent need of rehabilitation. The toe of its steep overflow spillway section was wearing away under the onslaught of discharges as high as 25,000 cubic feet per second. No one knew how serious the situation was until October 1951 when Bureau diver D. S. (Spud) O'Donnell made an underwater examination of the toe of the dam, feeling his way in 80 feet of murky water. Up to that time soundings had been taken to learn the extent of the erosion as excessive uplift pressures were known to exist in the dam foundation. In 1937–38 an unsuccessful attempt was made to unwater the toe. O'Donnell's inspection confirmed everyone's suspicions—erosion and undercutting had taken place at the toe.

Consulting Engineer John L. Savage was called into consultation. He and Chief Engineer L. N. McClellan forwarded urgent recommendations to Reclamation Commissioner Michael W. Straus that repairs be made before the heavy spring runoff. Emergency funds amounting to $500,000 were made available. The chief engineer expedited preparation of plans and specifications for the job. On December 21 bids were opened at Denver and contract awarded to Morrison Knudsen Co., Inc., of Boise, which had made the best offer. Before the month ended, M–K had equipment rolling onto the job and within days the initial job of constructing facilities for carrying stream flows past the construction area was under way.

Crews, working rapidly in raw snowy weather, began constructing facilities to divert the water around the toe of the dam where the concrete apron was to be added. A flume was formed by constructing a concrete wall along the right side of the river channel parallel to the 8,000-kilowatt power plant and retaining wall downstream, ex-



DRYING THE "TOE."—Above, close-up of the diversion facilities, showing 60-inch diameter steel pipes connected to the conduits at the face of the dam to carry discharges from sluice gates. At left, general view of the same area (outlined) before pipes were installed, showing the completed cofferdam and the diversion flume.

tending from the turbine outlets downstream for about 175 feet. The flume was to carry the combined discharge of the turbine outlets and two 5-foot sluice-ways—about 3,000 cubic feet per second. Discharges from the sluice gates were conveyed into the flume by 60-inch diameter steel pipes leading to a concrete cross-wall at the upstream end of the flume.

By early February the diversion works were finished and it was possible to unwater the toe of the dam. Two 12-inch electric deep-well turbine pumps and a number of gas engine suction pumps went to work running water from the hole. By mid-February the hole beneath Black Canyon Dam was unwatered. Soon thereafter, heavy mucking with a dragline and clamshell bucket had been finished and the contractor was ready to begin placing concrete. At the unwatered toe of the dam they had found a hole gouged 8 feet below the original foundation, extending under the dam several feet.

At this point, a board of engineers appointed by the chief engineer took a close look at the foundation preparation. There was some loose material that had to be removed, but the conglomerate and sandstone in the bottom was considered a

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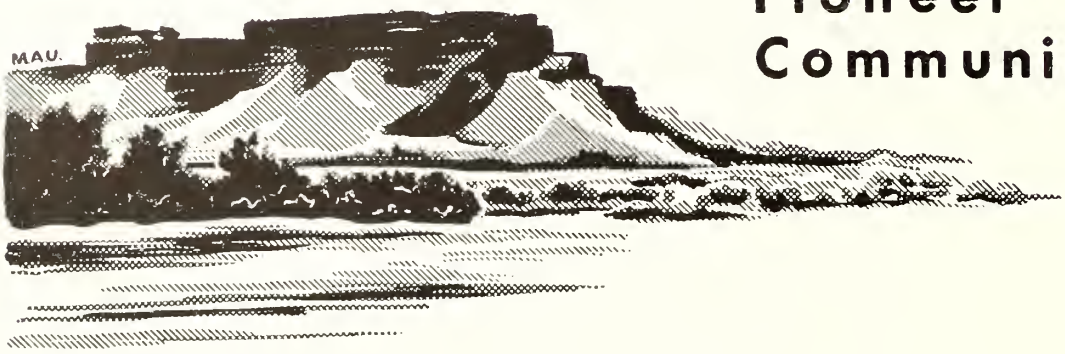
BLACK CANYON'S "STUBBED TOE."—This shows how the toe of the dam was eroded and undercut. After the cavity was cleaned out, a formation of hard, well-cemented conglomerate and sandstone was exposed, providing a firm foundation for repair.

SCOTTSBLUFF, Prizeworthy Pioneer Community



by TED PICKETT, Scottsbluff, Nebraska

The 16-year-old author, a junior at Scottsbluff High School, won first prize for the following article in Western Air Lines' "Sell your Community" essay contest, in which 22 high school and junior college students participated. Due to its references to irrigation and the North Platte project it is published here as a matter of interest to our readers, and an example of the younger generation's view of a reclamation area.

IF YOU'RE GOING WEST, why not travel the pioneer route? On your way stop and visit Scottsbluff, Nebr.

Scottsbluff got its start back in 1899–1900 when the Burlington Railroad extended its line further west. At first Scottsbluff wasn't much; but once the spark was kindled, things happened fast. After irrigation was introduced and the vast agricultural possibilities were tapped, Scottsbluff grew rapidly and its culture and government right with it.

The city is as historically significant as any in the State. The old Oregon and Mormon Trails and the Pony Express passed through this valley on their way westward. The broad, fertile valley of the North Platte River was an early fur trapper's paradise. A fur trapper, Hiram Scott, gave Scottsbluff its name by dying on a lonely bluff near here, deserted by his companions.

Chimney Rock, Courthouse Rock, Jail Rock, and Mitchell Pass are landmarks that guided the pioneers. They are still visible and are visited every year by thousands of tourists.

The construction of the Big Laramie and Tri-State Canals of 1904 turned what used to be part of the "Great American Desert," into America's Valley of the Nile. Soon after completion of these canals, the Great Western Sugar Co. built a beet sugar factory at Scottsbluff. This made the raising of sugar beets the most profitable agricultural industry. Although beets remain the most important crop, potato and bean production is increasing steadily. The sugar beet industry with its beet tops and pulp gave rise to livestock feeding, until this valley has become one of the principal beef and lamb producing areas in the United States. This high production could not be maintained if it were not for the abundance of alfalfa grown here. In turn Scottsbluff has become the leading meat packing and marketing center of the North Platte Valley. The Swift Packing Co. maintains the largest plant in this area. It ships carloads of dressed meat to leading cities, while smaller independent packing houses serve locally.

Today Scottsbluff has a very adequate educational system with excellent facilities. For her three thousand students, Scottsbluff has four modern grade schools, a new junior high, and a recently remodeled high school. By the new gym addition our high school has one of the best basketball setups for a school of its size. A new stadium was added to our football field. There is a well-rounded athletic program in each school and there are activities designed to interest every student, beginning in the grades, through high school and junior college.

Scottsbluff is lucky to have such excellent utility companies. The North Central Gas Co. of Wyoming has a local office which serves this vicinity with efficiency. Consumers Public Power District has a generating plant here which furnishes

electricity for miles around. A locally owned telephone company also employs many people to add its bit to Scottsbluff's industry.

Lately Scottsbluff has turned its interest in the direction of the oil business. Oil executives and a few movie stars have visited Scottsbluff to investigate oil possibilities. New producing wells are located south of Scottsbluff and a new pipeline is being installed to carry the oil to the refineries in larger cities. The Panhandle Co-Op has a refinery in Scottsbluff to refine some of the oil here. In connection with the refinery, Co-Op has two gasoline stations to sell its finished products. Oil companies have invested great sums of money to uncover oil possibilities in western Nebraska. Hopes are that new oil fields will be discovered here. This would help Scottsbluff economically. Already the effects of the new industry are being felt in Scottsbluff.

The city can't be mentioned without taking notice of the many potato cellars which dot the outskirts. The potato industry has become quite profitable in the last few years. Companies from large markets have numerous warehouses established and buy a high percentage of the potatoes grown.

Recently new alfamix mills have been popping up throughout this area to lessen the waste in feeding. Many products which ordinarily would be wasted are combined into a feed for livestock.

To bring Scottsbluff nearer the larger markets, she has good facilities to ship finished goods and products. Western Air Lines has convenient connections to all of the more important cities. The Burlington Railroad has a branch line which runs through the area and serves to connect it to other markets.

"ELECTRICITY FOR MILES AROUND."—The Lingle power plant, one of the first built by the Bureau of Reclamation, astride the Fort Laramie Canal which supplies irrigation water for the south side of the Platte valley. *Photo by Norton T. Novitt, Region 7.*

If you are interested in living in a climate of long sunshiny days, deliciously cool summer nights, mild winters tempered by the gentle chinook winds, you can't afford to overlook Scottsbluff. Many people come here with respiratory troubles and enjoy the clean, dry, healthful air.

The surrounding lakes, marshes, and rivers are abundant with wildlife. Sportsmen come here during the open seasons to hunt deer, ducks, pheasant, and geese. Many families come here for vacations because the fishing is good.

If you're looking for new frontiers, there are opportunities for enterprising people right here in Scottsbluff. ###

Black Canyon's New Apron

(Continued from page 19)

competent foundation for the 5,900 cubic yard apron. On February 23, concrete began moving into the hole while the flume arrangement was forcing the reluctant Payette River around the work area. Oldtimers, familiar with the runoff pattern of the Payette River, doubted the job would be done before the river rose. Day and night a concrete batching plant downstream from the dam was loading trucks which roared up to the big hole downstream from the dam, where a crane was swinging a 1 cubic-yard concrete bucket into the apron forms.

By March 25 the rising river had filled the Black Canyon Reservoir to near the dam's spilling level. On that day the last bucket of concrete had been placed and Black Canyon Dam was wearing its new apron. Four days later the water began spilling, but the contractor had removed virtually all the diversion facilities and equipment. Not enough time was available to completely remove the concrete flume wall. It had to sit alongside the river all summer until conditions permitted its removal.

The complete Black Canyon rehabilitation includes a concrete face for the rest of the dam and more concrete to strengthen the abutment sections. The rest of the work, however, can be done without unwatering. ###

Orland's Fertilizer Factory

(Continued from page 10)

scraps and lawn clippings are sufficient to feed a great number of worms.

"Any plant or animal material, provided it first has been decayed, will feed a worm," Mr. Starr declared. "A compost pile is my answer and it is a handy means of garbage disposal as well.

"I grind almond hulls for sugar and alcohol content, clover-seed cleanings for proteins, and for fats, black walnuts ground up with husks, shells and meats. In fact, you could say that my worms have cast-iron stomachs; they'll eat anything including old burlap sacks."

Earthworms not only eat practically anything, and are prolific in reproduction, but they have earned a reputation as the greatest living soil chemists and soil builders, the worm fancier said.

"A worm excretes an amount equal to his own weight each 24 hours," Mr. Starr said, "and this substance is the most perfect fertilizer known. It contains tremendous percentages of nitrogen, phosphate and potash. Sort of an automatic fertilizer factory, you might say.

"But best of all, he makes money for us, enriches the soil, makes the fisherman happy, provides the means for research, and he works for practically nothing. He's on the job 24 hours a day, 365 days a year, and never wants a raise in pay. In my opinion the lowly earthworm is not as lowly as most people think." # # #

Friant-Kern's Automatic Gate Tender

(Continued from page 14)

while, this large turn-out delivery does not vary by more than 2 cubic feet per second during the adjustment interval and thereafter returns precisely to the ordered flow.

Even comparatively small variations in turn-out flow make a life-sized problem for irrigation districts and farmers. Sam C. Fortier, engineer for the Delano-Earlimart District, says "Under manual operation last year we frequently were wasting water through the district, or the farmers at the lower end of the lateral couldn't get it. When you are dealing with a large main canal, such as Friant-Kern, a variation of 2 or 3 second-feet doesn't sound like much, but the average farm delivery is only about 2 second-feet and a reduction of this amount in turn-out delivery may mean no water to one or more of the farmers who are depending on it.

"Operation of the automatic canal level mechanism has been very satisfactory. It is particularly needed when we are taking minimum flows."

Ragle is enthusiastic about possible applications of the device developed by the operating staff under his direction. Looking into the future, he sees its possibilities for smoothing out the highly variable flow of CVP's 120-mile Delta-Mendota Canal, where operation of the Tracy pumps during off-peak power consumption periods is producing large fluctuations in flow and hence a sizeable canal operating problem.

But Manuel Aaron is happy about the results already achieved.

"That's one problem we don't have any more," he points out. ###

Trading Ideas for Profit

(Continued from page 15)

big Minidoka project. They stopped at a bench flume where Rosin-Amine D-acetate was being experimented upon as an algae controller. Farm delivery measuring devices were inspected and they chatted about the head loss requirements for the successful operation of a Cipolletti weir and an adjustable submerged orifice. There was discussion of the methods of delivering water and curbs on the excessive use of water, how to promote the most efficient distribution during the peak demand season, and dozens of other tricks in field operation. They talked of the general organization of various sizes of companies and districts, manpower requirements, equipment maintenance, performance of equipment and new developments to keep an eye on.

The handful of Bureau of Reclamation men in the group were also getting valuable tips and learning of problems facing other organizations. The operators, in turn, were learning that the Bureau was facing a maze of problems on not just their own, but on several other projects. Fresh understanding grew.

The 1952 field trip lasted 2½ days, and another half-day was devoted to a discussion period. The perpetual question was, "How can I cut costs?" There were plenty of possible answers. The trip promised to make itself felt throughout the year

in improved field operations and in the more favorable balance sheets of water users' organizations, as well as serving as an inspiration for other regions in the West to assemble in like manner for like benefits. # # #

Little Porcupine Plant Turbine Contract Let

Another contract for the "ten new starts" was awarded late in November to the Newport News Shipbuilding and Dry Dock Co. of Newport News, Va., to furnish three 8,400-horsepower hydraulic turbines for the Little Porcupine Power Plant of the Missouri Diversion Unit, Missouri-Souris Division of the Missouri River Basin project near Frazer, Mont.

The Porcupine Plant will provide more than 128 million additional kilowatt-hours of electric energy annually for eastern Montana and northwestern North Dakota where power requirements are relatively high because of extensive use of power in nonferrous metal industries.

According to the plans for the project, the Little Porcupine Power Plant will be built as part of the Missouri Diversion Dam 22 miles downstream from Fort Peck Dam. This diversion dam will divert water for the irrigation of more than 100,000 acres of land in the region. •

Settlement Opportunities

A tentative schedule of settlement opportunities on Reclamation projects during the coming year has just been announced. Veterans will have preference for homesteading or purchase in all cases. A total of 313 farms comprising 30,227 acres will be available for settlement either through homestead entry or purchase. Lands on the Columbia Basin project in the State of Washington are available for purchase with an opening date for late January or early February. Public lands on the Minidoka project in Idaho will be available for homesteading about the same time.

Public lands in the Coachella Division of the All-American Canal project in California are scheduled for opening about May 1953, while acquired lands in the Wellton-Mohawk Division of the Gila project in Arizona will be available for purchase around October.

On the Angostura project in South Dakota, lands will be sold to settlers by the Soil Conservation Service around June 1953. This action is being taken under the Wheeler-Case Act.

For further information, write to your nearest Regional Director. See directory on inside back cover of this issue. •

Pactola Dam Contract Awarded

The Adler Construction Co. of Loveland, Colo., was awarded the contract for construction of the Pactola Dam and Reservoir in western South Dakota on October 14. The work, which provides for a 225-foot high, 1,250-foot-long earth-fill dam with 2,100 feet of dikes, will be completed as speedily as possible to provide storage space for 99,000 acre-feet of Rapid Creek water, a major part of which will be used to furnish a full supply for the Rapid City Air Base and the municipality of Rapid City.

The Rapid City Air Base has not had an adequate water supply since its establishment in 1942 and at one time during the war it was necessary to haul 100,000 gallons of water per day in tank trucks from Rapid City to meet the demands. This project, one of the "ten new starts," and the key water control structure in the Rapid Valley Unit, Cheyenne Division, Missouri Basin project, will also provide flood protection for Rapid City, and additional recreational opportunities along with fish and wildlife protection, and ultimately furnish a full supply of irrigation water for 2,200 acres of new land and a supplemental supply for 8,900 acres. •

FIRE AND ICE

Shortly after the December issue of the RECLAMATION ERA went to press we received a communication that had very definite bearing on the article entitled Riverton's "Slush Plow" on page 280. We were advised that the plows had been destroyed by fire at the Wind River Diversion Dam. However, Project Manager Mendenhall informs us that orders have been placed for new motors and propellers so the slush plows may be put into use during the winter season. •

NEXT MONTH—THE FIRST YEARS ARE THE HARDEST—stories of the problems facing the people who are operating the Columbia Basin and Central Valley projects.

NOTES FOR CONTRACTORS

Contracts Awarded During November 1952

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DS-3776	Central Valley, Calif.	Nov. 13	Two 230,000-volt circuit breakers and 1 bushing potential device for Folson-Elverta terminal switching facilities.	Brown Boveri Corp., New York, N. Y.	$99,300
DC-3781	Missouri River Basin, S. Dak.	Nov. 21	Construction of 55 miles of Oahe-Midland 115-kv. transmissiou line.	R. N. Campsey Construction Co. and C. F. Lytle Co., Denver, Colo.	508,432
DS-3793	Missouri River Basin, Mont.	Nov. 21	Three 8,400-hp. hydraulic turbines for Little Porcupine power plant.	Newport News Shipbuilding & Dry Dock Co., Newport News, Va.	835,800
DS-3799	Central Valley, Calif.	Nov. 13	Four vertical-shaft pumping units for Contra Costa pumping plants Nos. 1, 2, 3, and 4.	Fairbanks Morse & Co., Kansas City, Mo.	71,837
DC-3801	Cachuma, Calif.	Nov. 5	Construction of earthwork, pipelines, and structures for 12.8 miles of Glen Anne laterals, Goleta distribution system.	R. A. Wattson Co., North Hollywood, Calif.	522,816
DC-3808	Gila, Ariz.	Nov. 7	Coustruction of earthwork, concrete canal and lateral lining, and structures for Wellton eaual, lateral M-14.8, and Unit 1, Wellton distribution system.	Morrison-Knudsen Co., Inc., Los Angeles, Calif.	1,318,474
DS-3811	Columbia Basin, Wash.	Nov. 26	Five lots of radio communication equipment, 10 mobile radio transmitter-receiver assemblies, and 600 linear feet of radio frequency coaxial cable for Othello, Ephrata, Warden, Mesa, and Eltopia substations.	Motorola, Inc., Chicago, Ill.	11,049
DS-3813	do	Nov. 20	Structural steel for railroad bridges on East Low canal.	Bethlehem Pacific Coast Steel Corp., Seattle, Wash.	47,322
DC-3817	Missouri River Basin, Kans.	Nov. 5	Construction of Webster dam foundation.	H. N. Rodgers & Sons Co., Memphis, Tenn.	993,870
DC-3818	Central Valley, Calif.	Nov. 28	Furnishing and installing 1 electric elevator in service bay of Folsom power plant.	Independent Elevator Co., Inc., Sau Francisco, Calif.	39,995
DC-3820	Rivertou, Wyo.	do	Furnishing and applying catalytically blown asphalt membrane lining to 6.99 miles of Pilot and Wyoming canal laterals.	Studer Construction Co., Billings, Mont.	29,460
DC-3821	do	do	Furnishing and applying asphaltic membrane lining and cover material to 0.85 mile of Wyoming canal and 6.15 miles of lateral.	L. H. Weber, Rawlins, Wyo.	85,010
117C-173	Columbia Basin, Wash.	Nov. 20	Residence, farm buildings and utilities at Othello development farm.	Westover and Hope, Quiney, Wash.	29,695
117C-174	do	Nov. 5	Earth blanketing, Potholes East Canal.	Riverbend Contractors, Inc., Portland, Oreg.	32,300
200C-218	Central Valley, Calif.	Nov. 4	Constructing headquarters camp at Sly Park.	Tricon Construction Corp., San Rafael, Calif.	95,416
300C-48	Colorado River Front Work and Levee System, Ariz.-Calif.-Nev.	Nov. 19	Furnishing and erecting shop building at Needles, Calif.	Pascoe Steel & Constructing Co., Pomona, Calif.	20,443
300C-50	Gila, Ariz.	Nov. 14	Repair of concrete canal lining, Wellton-Mohawk, Wellton and Mohawk Canals.	Young & Smith Construction Co., Salt Lake City, Utah.	254,220
601C-29	Shoshone, Wyo.	Nov. 20	15 miles of drains, Heart Mountain Division.	D. M. Manning, Contractor, Hysham, Mont.	115,297

Construction and Materials for Which Bids Will Be Requested by March 1953

Project	Description of work or material
Central Valley, Calif.	Construction of 760 foot long by 175 foot high earth- and rock-fill Sly Park Dam, part of the American River Basin development, also involves a 600 foot long by 97 foot high earth-fill dike, an outlet works, and uncontrolled spillway. Total volume of dam and dike will be about 1,100,000 cubic yards. The dam will be in Eldorado County near Camino, Calif.
Do.	Construction of 8 power turnouts of 2- to 9-c. f. s. capacities, 3 gravity turnouts, and 20 laterals consisting of 10 miles of 12- to 30-inch diameter concrete pipe for Plainview Water District distribution system on the Delta-Mendota canal about 2.5 miles southwest of Tracy, Calif.
Do.	14 vertical-shaft, motor-driveu pumping units from 2- to 7-c. f. s. capacities and heads from 10 to 31 feet, aud 8 vertical-shaft, motor-driven moss screen pumping units from 180 to 360 g. p. m. at 230-foot head for Delano-Earlimart irrigation district.
Do.	2 vertical-shaft, turbine-type, 350-g. p. m. unwatering pumping units; 3 vertical-shaft, turbine-type, 500-g. p. m. drainage pumping units; 2 horizontal-shaft, centrifugal-type, service water pumping units; 3 gear-type oil pumping units; and 2 sludge pumping units for Folsom power plant.
Colorado-Big Thompson, Colo.	Construction of 2.5 miles of 28-foot wide, gravel-surfaced Pole Hill aecess road, including corrugated metal pipe culverts and a 118-foot long timber bridge, 5 miles west of Loveland, Colo.
Do.	Iustallatiou of circuit breaker and 69-kv. metering equipment at Holyoke substatiou.
Columbia Basin, Wash.	Constrnction of a 1-story, 7,240-square-foot masonry structure with partial basement for guard and fire headquarters at Coulee Dam, Wash.
Do.	Construction of 6 pumping plants for Lateral Area E-5 on East Low canal near Warden, Wash., with following capacities: 135 c. f. s. Warden plant consists of three 45 c. f. s. units; Warden relift plant, two 20.5 c. f. s. and two 8 c. f.s. units; North Warden plant, three 24 c. f. s. units; EL 63.1E plant, two 4.5 c. f. s. units; EL 61.7 plant, two 7 c. f. s. units; EL 61 plant, two 8 c. f. s. uuits.
Davis Dam, Ariz.	Erecting steel structures and installing electrical equipment at Prescott substation.
Davis Dam, Ariz.-Nev.	Interior painting of all metalwork, structures, and equipment in Davis dam and power plant.
Eden, Wyo.	The 4-mile second section of Eden canal, 44 miles uorthwest of Rock Springs, Wyo., requires 1 mile each of 300 and 150 c. f. s. capaeity and 2 miles of 260 c. f. s. capacity partially earth-liued canal, and additioual 4 miles of 40 to 6 c. f. s. capacity Eden laterals E-7, E-11, and E-12. About 250,000 cubic yards of excavation are required.
Gila, Ariz.	6 vertical-shaft pumping units for Dome pumping plant of the following capacities: Three 20 c. f. s. at 11.5-foot head, and three 26.7 c. f. s. at 20.5-foot head.
Kendrick, Wyo.	Repairing and widening bauks and placing asphalt membrane lining on 0.42 mile of Casper canal in Natrona County, Wyo., about 26 miles southwest of Casper.
Missouri River Basin, Iowa.	Construction of 53,000-kv-.a. capacity Sioux City substation near Sioux City, Iowa, involves furnishing and erecting steel structures and a 24- by 44-foot prefabricated steel control building and installing government-furnished electrical equipment. Equipment includes one 53,333/66,667-kv.-a. autotransformer; and 230- and 69-kv. circuit breakers and disconnecting switches, and a 69-kv. voltage regulator.
Missouri River Basin, Mont.	Construction of Missouri diversion dam consists of 2.3 miles of earth dike embankment aeross Missouri River near Wolf Point, Mont., a gated concrete overflow section 80 feet long and 40 feet high, and 350 feet of concrete retaining wall 35 to 60 feet high. The earth dike is to be 30 feet high for 11,000 feet and 50 feet high for 1,000 feet. The 3-unit, 18,000-kw. Little Porcupine power plant will have a reinforced concrete snbstructure 103 by 188 feet and 70 feet high and a government-furnished stee superstructure measuring 57 by 188 feet and 45 feet high with insulated steel panel walls. The upstream portion of the power plant structure is designed to act as a gravity dam against the reservoir. The contractor will construct spiral casings and install embedded

Construction and Materials for which Bids Will Be Requested by March 1953—Continued

Project	Description of work or material
Missouri River Basin, Mont.—Continued	parts of 3 turbines, each 8,400-hp. at 30-foot head; install a 60-ton government-furnished bridge crane; and grade the switchyard area. Also included are the headworks structures for the 7,500 c. f. s. Missouri canal which will have three 16- by 6-foot top seal radial gates, and headworks for South Side canal, three 60- by 48-inch and three 60- by 36-inch hand-operated slide gates and reinforced concrete outlet boxes.
Do	Construction of 7.5 miles of 100 to 35 c. f. s. Toston canal and wasteway, 3 miles of 60 to 20 c. f. s. Lombard canal and wasteway, and lateral and drainage systems.
Do	Construction of 100 c. f. s. Crow Creek pumping plant, 4 miles southwest of Toston, Mont., on the Missouri River, designed to lift water from the river an average of 176 feet through a 1,180-foot long, 52-inch inside diameter steel pipe discharge line to Toston tunnel for gravity flow to Toston and Lombard canals.
Missouri River Basin, Nebr.-Kans.	Construction of a Kansas River District headquarters building at McCook, Nebr., involves converting a 14,000-square-foot brick building into an office building, and constructing a 1-story 2,000-square-foot addition with a basement of the same floor area, a concrete foundation, steel columns, and tile walls. Contract also includes constructing footings, foundations, and concrete floors for several other buildings to be erected under other contracts; and furnishing and erecting a 50- by 100-foot prefabricated warehouse; grade and surface the area; and install facilities.
Do	Construction of 11 miles of unlined Naponee canal, laterals, drains, and appurtenant reinforced concrete structures 12 miles west of Franklin, Nebr., on the south side of the Republican River, beginning at Harlan County Dam.
Do	Franklin canal's first section requires construction of 18 miles of unlined laterals and appurtenant reinforced concrete structures, near Franklin, Nebr. Capacity ranges from 12 to 6 c. f. s.
Missouri River Basin, N. Dak.	Relocation of about 1 mile of the Edmond Road in the Jamestown reservoir area near Jamestown, N. Dak.
Do	Raising and gravel surfacing about ½ mile of Buchanan Road and constructing a new bridge over the James River in the Jamestown Reservoir area. Requires about 130,000 cubic yards of excavation.
Missouri River Basin, S. Dak.	Construction of the Cherry-Todd addition to the Winner substation; and the transportation and installation of power transformers at Winner, Gregory, and Bonesteel substations, all in southeastern South Dakota.
Do	Furnishing and installing three 795 MCM ACSR conductors and two ½-inch stranded steel overhead ground wires, including insulators and related hardware, on the 122-mile Fort Randall-Sioux City 230-kv. transmission line.
North Platte, Wyo	Repair of Lingle wasteway, Fort Laramie Canal, in Goshen County about 2 miles south of Lingle, Wyo., involves replacing 3 concrete floor slabs, repairing walls and floor around tubes; a concrete cut-off wall and underdrain.
Palisades, Idaho	Relocation of 5.5 miles of State Highway No. 29 about 62 miles southeast of Idaho Falls, Idaho, from Big Elk Fill to Indian Creek, requires about 1,200,000 cubic yards of excavation.
Riverton, Wyo	Construction of additional North Pavillion drains near Riverton, Wyo.
Shoshone, Wyo	Lining of short reaches of the Heart Mountain Division canal and laterals near Powell, Wyo.
Solano, Calif.	Monticello dam is to be a 260,000-cubic-yard concrete arch dam about 295 feet high above ground and 1,000 feet long at the crest, with glory-hole type spillway and penstock-type outlet works, located on Putah Creek, 39 miles west of Sacramento, Calif. The spillway will have a 72-foot diameter uncontrolled crest and a 28-foot diameter outlet tunnel. The outlet works will consist of two 90-inch penstocks through the dam with valve controls. Concrete will require about 1,500,000 pounds of reinforcing steel. In addition, the contract is to include a 500-foot long concrete highway bridge and a 400-foot long timber bridge over Putah Creek, and some road construction. The concrete bridge will have concrete abutments, nine piers, and nine 55-foot spans; the timber bridge will have timber bents and concrete footings.
Yakima, Wash	Construction of 2 monolithic reinforced concrete railroad undercrossing siphons, 350 and 250 feet in length, on the Chandler power canal, 4 and 6 miles east of Prosser, Wash. Each siphon is to have two 11.5-foot inside diameter barrels and inlet and outlet transitions.
Do	Construction of 6.6 miles of 435 c. f. s. capacity Chandler irrigation canal and 0.6 mile of 435 c. f. s. capacity wasteway for the canal's first section, near Prosser.

United States Department of Interior, Oscar L. Chapman, Secretary

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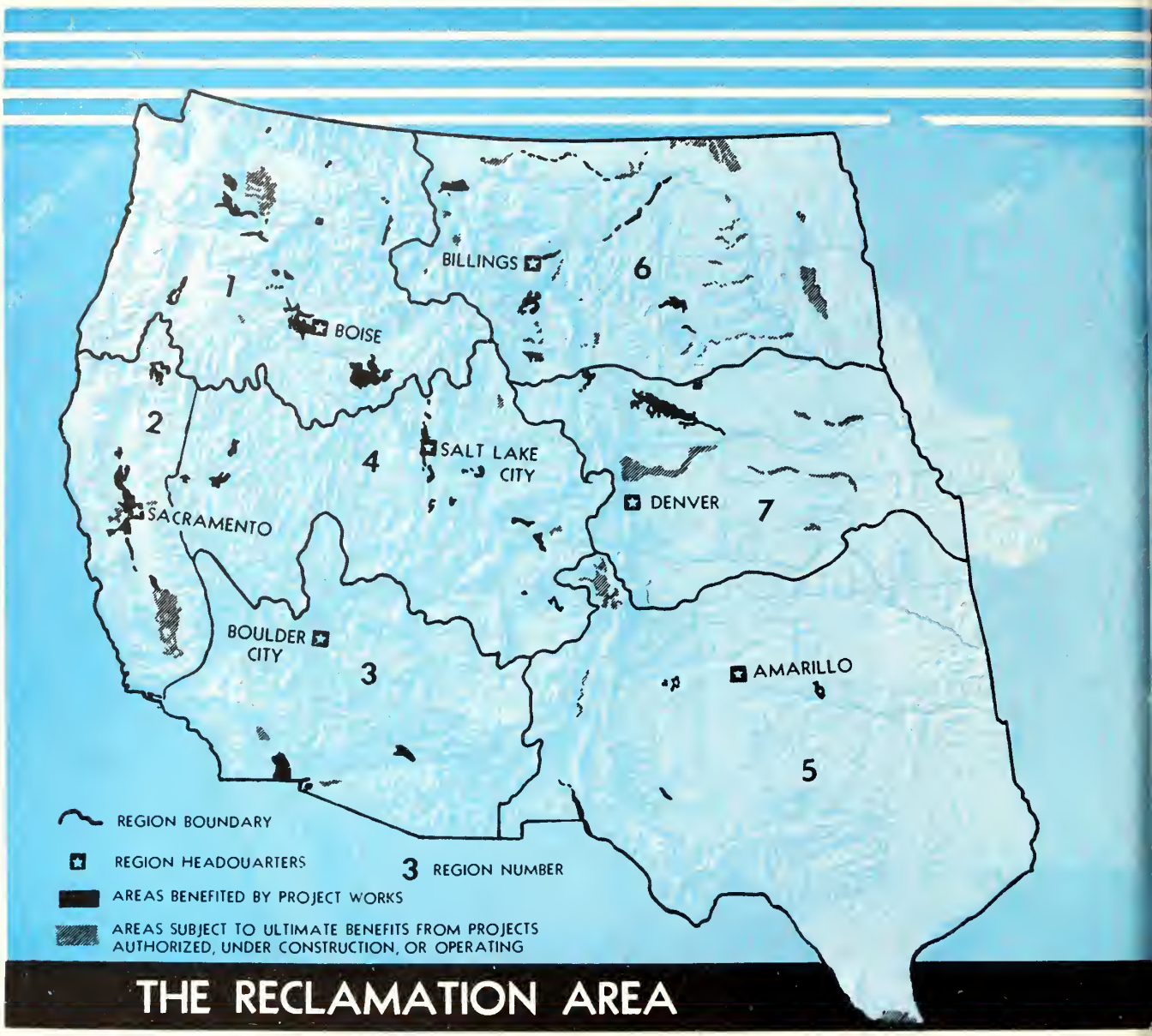

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The Reclamation ERA

Official Publication of the Bureau of Reclamation

February

1953

IN THIS ISSUE:

February 1953

Volume 39, No. 2

The Reclamation ERA

35 Years Ago In The Era

Remember: Alfalfa Is a Basic Crop

Far-seeing men on the reclamation projects and elsewhere are concerned about a decrease in the alfalfa acreage on some of the projects last season—decreases in favor of food and other seemingly more urgent crops. I went to see an official of the United States Department of Agriculture to find out how serious the situation is and to get a statement for readers of the RECLAMATION RECORD.

"Tell them not to forget alfalfa. Tell them that such practicable adaptations in their farming as are necessary better to meet the Nation's emergency food needs are advisable, but to remember and not to minimize the importance of the crop that makes it possible to live and to build up successful farming systems on reclamation projects. Say to them that a dead goose does not lay golden eggs; that unless the foundation crop—alfalfa—is firmly established and maintained, other farming ventures cannot be undertaken with an assurance of permanent success."

(From an article on page 53 of the February 1918 issue of the RECLAMATION RECORD, predecessor to the RECLAMATION ERA.)

OUR FRONT COVER. SEE THE DIFFERENCE? Inset, corn grown without irrigation. In an adjoining field near Sargent, Nebr., was grown the lush crop of irrigated corn in the foreground. See article entitled, "Sargent Looks Ahead" on page 30. Photos by F. B. Slote, Region 7.

OUR BACK COVER is based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners Kittredge and Coolidge.

DESIGN AND ILLUSTRATIONS by Graphics Section, Bureau of Reclamation, Washington, D. C.

R. F. Sadler, Editor

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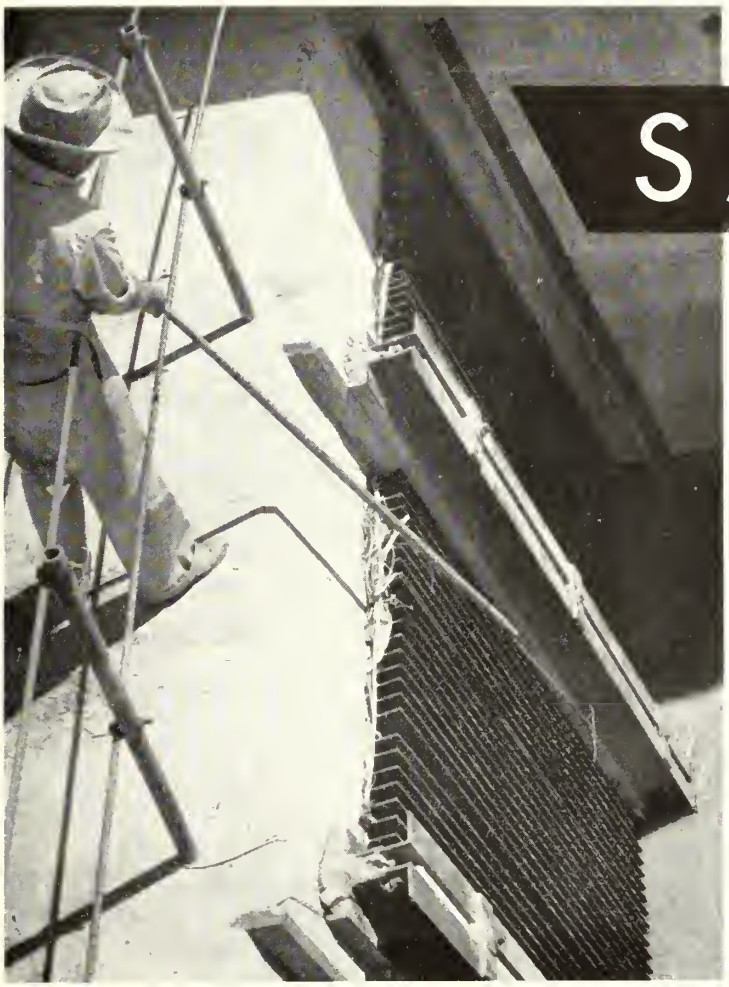
In this issue . . .

RECLAMATION PLACE NAMES IN THIS ISSUE



SAFETY IN CANAL OPERATION

by R. J. WILLSON,
Assistant Operation and Maintenance
Liaison Representative,
Design and Construction Division,
Denver, Colo.

GUARDRAILS FOR PROTECTION.—On the Buffalo Rapids project in Montana, operators who remove trash from the pumping plant trashrack decks have these essential safeguards. ***Photo by S. T. Larsen, Design and Construction Division, Denver, Colo.***

THE BUREAU'S PROGRAM TO REDUCE ACCIDENTS on irrigation canals and their related structures has a twofold aim—to protect the general public and water users who visit our irrigation works and to protect the operation and maintenance employees who must daily and necessarily expose themselves to the ever-present hazards.

Warning signs and protective fences which are effective in protecting the public, are not protection for the employee who is operating gates, cleaning trashracks, or doing repair work. Many methods are being used and others are being studied to reduce the risk in performing these necessary jobs.

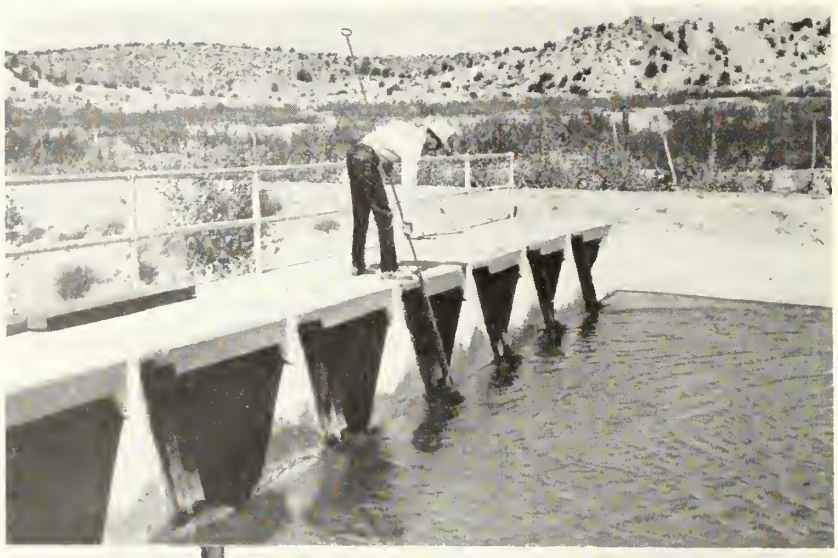
During the last decade, great strides have been made in the construction of large irrigation works. These complicated and larger works, however, have increased the hazards in operating and maintaining them. Extra vigilance and the incorporation of new safety measures are necessary if we are to provide the operating employees with the protection they have a right to expect.

What has been done and what is being done on Bureau of Reclamation projects to eliminate accidents to operation and maintenance personnel? We are doing two things: namely, we are trying to educate our employees to follow approved safety practices, and we are installing protective devices.

Along the line of educating our employees, we are emphasizing the importance of "good housekeeping" about structures and alerting the men to watch for safer ways to do their work. The absentminded, careless, or unthinking person is very likely to meet with an accident sooner or later, while the alert, intelligent, and careful individual can work for years under hazardous conditions without getting hurt. Numerous regu-

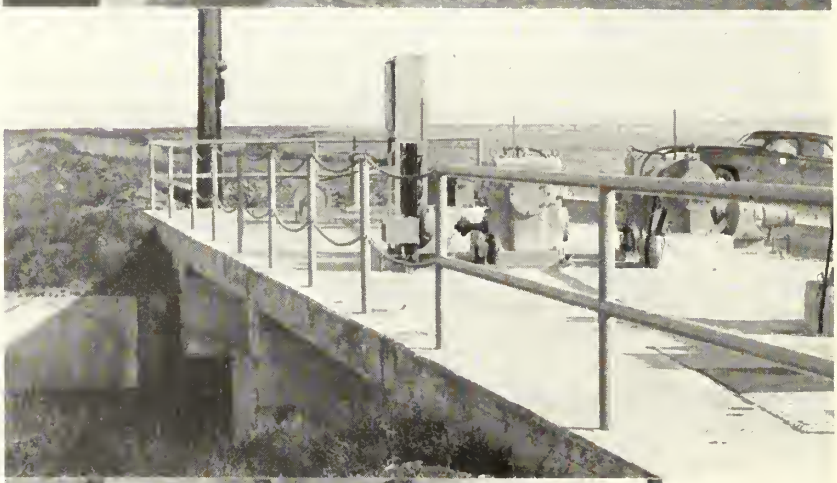
THIS—

PULLING STOP-LOGS from a check as this operator is doing on the Tucumcari project in New Mexico can become an extremely hazardous operation. Suppose he should lose his balance while handling a particularly stubborn stop-log? Or suppose the catwalk were slippery? Of course, it's all in the day's work. But who wants it to be the last day of his life? Region *5 photograph.*



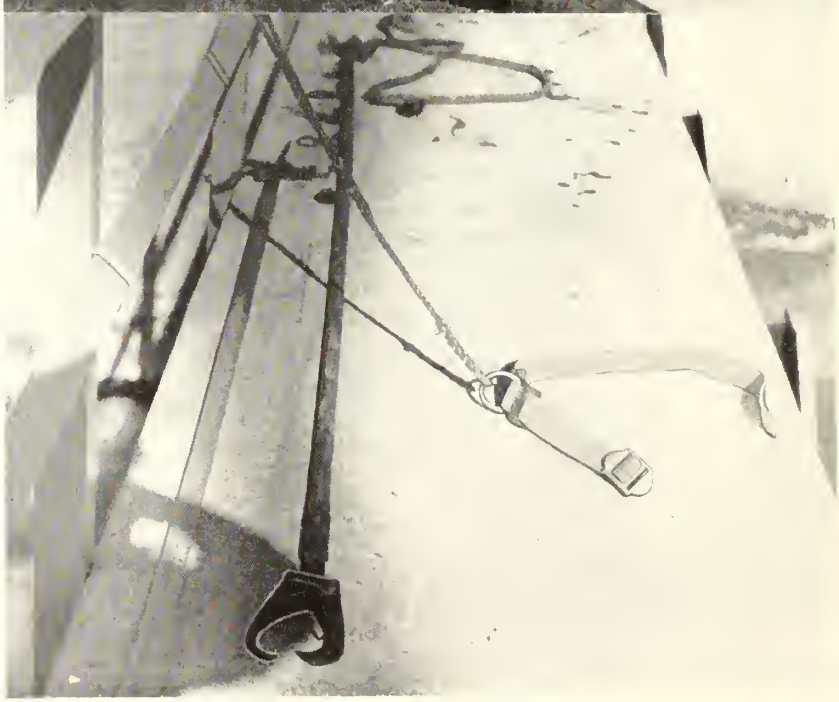
WITHOUT THIS—

A CHAIN-GUARDRAIL installed at a wasteway headworks on the Columbia Basin project in the State of Washington can be removed if necessary to permit full access to the working area over the gate bays, but while in position is a protection to operation and maintenance personnel. Other removable guardrails have been installed elsewhere on Reclamation projects. *Photo by S. T. Larsen.*



OR THIS—

A SAFETY BELT is provided on the Riverton project in Wyoming to guard operators handling stop-planks. The belt, spread out for inspection, is normally fastened to the guardrail by rope and chain which slides along the rail between posts. This check is at the head of a high velocity chute. *Photo by S. T. Larsen, Denver, Colo.*



CAN BE FATAL.

lations governing safety practices have been issued to cover many activities and these regulations are the groundwork upon which sound, safe work habits can be built.

Our more hazardous structures are being designed with guardrails around dangerous areas for the protection of both operators and visitors. Not so long ago, a pump operator who was cleaning debris from a pumping plant's trashracks slipped and fell into the deep water of the forebay. He managed to get out and returned to his work. But the operating deck was slippery, and the debris was so hard to pull that he soon slipped and fell in the water again. After a struggle he got out again. Although we admire his persistence, we regret such a dangerous incident had to occur before the need for protective facilities was clearly realized. Needless to say, that particular pumping plant is now equipped with a guardrail on the trashrack operating deck.

To give better footing on wet, icy, or snow-covered walkways, steel gratings are being substituted for concrete. Metal foot plates with roughened or abrasive surfaces are being used on stairs and operating decks to provide better traction. To prevent falls, wire netting or grating is provided as a cover over structure openings. Canal bank operating roads are being surfaced with gravel to minimize skidding danger. Approaches to bridges and canal crossings are being clearly marked for better visibility, both by day and by night.

For the operator of large valves or gates, a hooked bar has been designed. It gives additional leverage and the hook assures the user that this instrument will not become disengaged, causing him to plunge off the operating platform.

Electrical pumping equipment and switchyards are being housed or fenced, thus preventing the general public as well as the operation and maintenance personnel from coming in contact with "live wires" or moving machinery.

Power-operated gates and valves, which eliminate excessive physical strain on the operators, are replacing hard-to-operate handwheels.

Extra manholes have been provided in many long reaches of conduit, intake or discharge pipes. These make access easier and provide better ventilation for those inspecting or repairing the conduit.

A fatal accident occurred at one of our older diversion dams because the operator was not able to see the sluiceway while operating the gates. In this instance, although warned that a head of water was coming his way, a fisherman, trying his luck in the deeper holes of the sluiceway channel, was drowned. This incident emphasizes the importance of having controls located so that the operator can see what is going on.

SPECIAL SAFETY AWARD is given to H. F. Bahmeier, right, construction engineer for the Bureau of Reclamation's American River division in northern California, by Sergeant George J. Barron of the California Highway Patrol for the safety record compiled during the past year. Government vehicles were driven 250,000 miles in 1952 without an accident. Much of the driving was in rough or mountainous terrain. The presentation was made at Folsom, Calif.

Signs, caution signals, and warning devices such as sirens, bells, and lights are installed where operational hazards exist. Inspection of unsafe conditions is made regularly by qualified inspectors.

Numerous types of escape devices are provided to protect both operation personnel and any others who may be caught in the swiftly moving waters of a concrete lined irrigation canal. Ladders placed at regular intervals on the slopes of concrete canals are a common self-escape installation. Other devices such as cables and floats give any unwary person a greater opportunity to save himself. On many projects, suspended cables with dangling ropes and floats have been installed between side slope ladders, particularly above siphons or inlets to other underground works. On other projects it has been found that trashracks make effective self-escape devices, and safety nets are in common use.

The Bureau is continuing to test and study various devices which will reduce the number of accidents on its irrigation canals. But with all these safety devices we must still use common sense to protect ourselves. ###

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CONTROLLING CORN ROOT WORM DAMAGE as shown by Arnold W. Petersen, at right, is done by spraying at the Nebraska Development Farm. Below, farmers learn from John Schrunk of the University of Nebrosko how to adjust one of the many varieties of check dams for heod control. *All photos for this orticle, courtesy of The Hostings Doily Tribune, Hostings, Nebr.*

NEBRASKA-BOSTWICK DEVELOPMENT FARM

by ARNOLD W. PETERSEN, Agriculturist
Kansas River District
McCook, Nebr., Region 7

"How do you like irrigation? Does it pay? What is the cost per acre for land leveling?"

Farmers from miles around ask Willard Stenson these questions and many more like them. Stenson is a "cooperator" on the Nebraska-Bostwick Irrigation Development Farm 5 miles east of Superior, Nebr. This means that he is cooperating with local, county, State and Federal agencies in a combination "know-how" and "show-how" program.

He and his father, Everett Stenson (who bought the farm in 1949 and rents it to 27-year-old Willard) provide some of the general farming "know-how." Irrigation lore is provided by members of an inter-agency group consisting of representatives from the Nebraska Bostwick Irrigation District, the Extension Service, University of Nebraska, Experiment Station, Bureau of Plant Industry, Soil Conservation Service, and the Bureau of Reclamation.

Members of this group selected Willard as a cooperator in the fall of 1950. They were looking for a farm which had typical development problems and a resident-operator who was interested and willing to develop the farm as quickly as possible. They wanted to show farmers of the Bostwick Irrigation District how irrigation would work in the area, if certain recommended irrigation practices were followed. They also wanted to try out some experiments in improving the use of irrigation water in the area on a practical, yet scientific, basis.

Willard and his father worked out a plan of development cooperatively with the committee, and have followed it with minor adjustments. In 1951 they started using water from the Bostwick Irrigation District via the Superior Canal, recently completed by the Bureau of Reclamation. This and other canals to be constructed will provide irrigation water for lands in the District

which are located between Napones and Hardy in south central Nebraska.

The inter-agency committee, after completing the work plan, delegated one man to work with Willard. He is Paul Fischbach, the District Extension Irrigation Engineer from the University of Nebraska, who works on irrigation development throughout the Republican River watershed in Nebraska. He often calls upon the Extension Service and the Soil Conservation Service for technical assistance. The County Agricultural Agent supplies advice on crop varieties, fertilizer requirements, corn root worm control measures, and other recommendations when needed. Technicians from the Soil Conservation Service made a detailed topographic survey of the farm and estimated the land grading requirements. They also gave technical assistance in carrying out the actual land grading operations, design of farm structures, and location of a farm distribution and drainage system.

Stenson and Fischbach are rapidly developing the 97 irrigable acres on the Stenson farm. They have completed heavy land grading on 51 acres, and have only about 8 acres more to grade. So far it has cost $28.00 an acre for grading the 51 acres. In 1951, they had 63 acres under irrigation and in 1952, brought 26 additional acres under water. Next year they will irrigate an additional 8 acres to bring the entire 97 acres into production.

Average yields on the farm were good in 1952. The corn averaged 85 bushels per acre, the oats 55, and the atlas sorgo silage 18 tons per acre. A top yield of 136 bushels of corn per acre was produced on land which had been in sweet clover in 1950 and planted to corn in 1951 and again in 1952. The field was sprayed with one-half pound per acre of gamma isomer of B. H. C. (benzene hexachloride) for corn rootworm control; 10 tons of manure were applied to each field in the spring and 45 pounds of available nitrogen as a side dressing at the last cultivation.

The Experiment Station had two corn fertilizer plots in 1952 to study corn yields with and without starter fertilizer and with and without supplemental nitrogen fertilizer applied at two different times. Another test was conducted to study the effect of different application rates of nitrogen applied as a side dressing to corn at the last cultivation. Results of these two tests are not available at this time but will be released by the University of Nebraska.

TESTING STARTER FERTILIZER.—Dr. Mark Weldon, University of Nebraska, showing a group of farmers a test plot of corn during the farm field day held at the Nebraska-Bostwick Development Farm on September 10, 1952.

Apparently soil fertility was a limiting factor in the production of crops under irrigation on this farm. A positive program of legume planting was begun before irrigation water was available and is now being intensified by the planting of a larger acreage of legumes and grasses. In addition, heavy applications of manure and commercial fertilizers (nitrogen) will supplement this program.

Grain, silage, hay, and pasture crops will be fed as needed to the herd of 14 to 20 purebred Guernsey dairy cows Willard maintains. In addition, feeder pigs and cattle will be fattened on the grains and roughage produced in large quantities by the 97 acres of irrigated land. About 47 acres of land above the canal cannot be irrigated unless a sprinkler system is used. This land, formerly in dryland row crops, is being seeded to grass for use as pasture.

The farm lateral distribution system is primarily designed to eliminate permanent ditches. Two basic reasons for following this principle are: (1) Weed control is a problem with permanent constructed ditches; and (2) hand labor is materially reduced by construction of the lateral next to the row crop to be irrigated. A commercial farm

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SARGENT LOOKS AHEAD

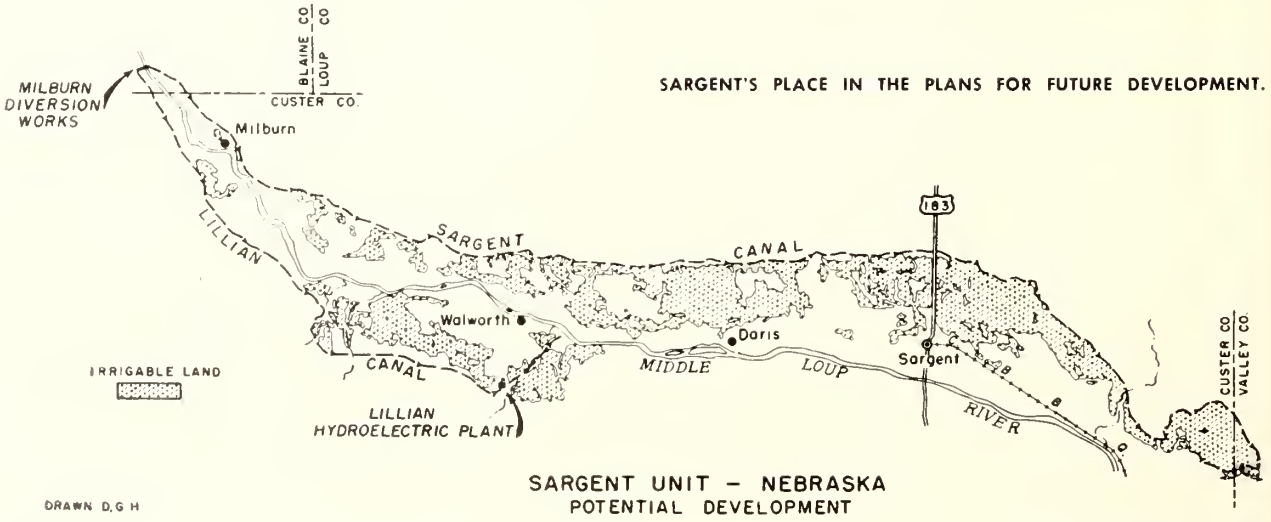
SARGENT AS IT LOOKS TODAY.—*All photos for this article by F. B. Slote, Lower Platte River Area, Region 7.*

by ALDON D. NIELSEN, Agricultural Economist
Lower Platte River Area, Grand Island, Nebr., Region 7

"We want irrigation and we are doing everything within our power to get it," said George Semler on October 30, 1952. Semler, who is vice-president of the Loup Basin Reclamation District and member of the board of directors of the Nebraska Reclamation Association, demonstrated why, by showing us the difference between irrigated corn and dryland corn on the Fred Cole Farm 2 miles northwest of Sargent, Nebr., in the Middle Loup River Valley.

Mr. Cole operates a 440-acre general crop and livestock farm of which 260 acres are cropland. About 75 acres are under irrigation from an 8-inch well having a capacity of approximately 1,100 gallons per minute. Mr. Cole practices a crop rotation of corn and alfalfa. His irrigated corn in 1952, the first year following 3 years of alfalfa, averaged 75 bushels per acre. Dryland corn on the same farm and under similar conditions, ex-

SARGENT'S PLACE IN THE PLANS FOR FUTURE DEVELOPMENT.



cept for irrigation, averaged only 15 bushels per acre. Irrigation in this case was worth 60 bushels per acre, which at the current price of corn in Sargent, represents an increase in gross return of $84 per acre. In addition to the direct increase in returns per acre, irrigation has served as good insurance against the unstabilizing effects of drought upon Mr. Cole's farming operations. Several other farmers in the Sargent community irrigate small portions of their cropland from wells; however, water-bearing formations through this area in many cases are not conducive to good yields of water and so restrict the acreage that can be irrigated. Farmers, when operating under such limitations, generally irrigate as much of the corn in their rotation as possible since corn gives the greatest immediate response to water in terms of cash returns. Even so, the water application generally is less than the optimum for maximum crop production.

Mr. Semler, now 66 years old, has witnessed a large and steady flow of high quality water down the Middle Loup River all his life. He has thought long and often of the great production potential of the valley lands if an irrigation system could only be developed that would adequately and economically serve the many acres suitable for irrigation. He has seen farms and farmers "flow down the river" in the sense that they met economic setbacks or defeat as a result of drought while the old river flowed idly by.

The severe drought of 1894 forced Mr. Semler's parents to return with their three children to their native community of Durand to seek employment. The trip took 28 days by team and wagon. After finding employment and securing a subsistence for the family through the winter, they returned to Sargent in the spring of 1895 and put in their crop. Many other farmers met economic distress, a situation which has continuously repeated itself simply because irrigation water was not available for the lands and crops of this valley. The Sargent area has shown a decrease in population each census year since 1920.

In the early 1940's, George Semler, Jerry Coonrad (now deceased), Fay Spooner, Rev. Edward A. Smith, and others interested in irrigation development, organized the Upper Middle Loup

(Please turn to page 45)

"SEE FOR YOURSELF," says George Semler, as he visits a field of irrigated corn (top photo), and then stands in an adjoining field of the same crop—but not irrigated.

OPERATING THE COLUMBIA BASIN PROJECT

CLEANING WEEDS FROM A TURN-OUT.—William Amoureaux, ditchrider in the Winchester water section, uses a long-handled weed fork. *Photo by F. B. Pomeroy, Region 1 photographer.*

by E. H. NEAL, Supervisor,
Operation and Maintenance Division,
Columbia Basin Project, Ephrata, Wash., Region 1

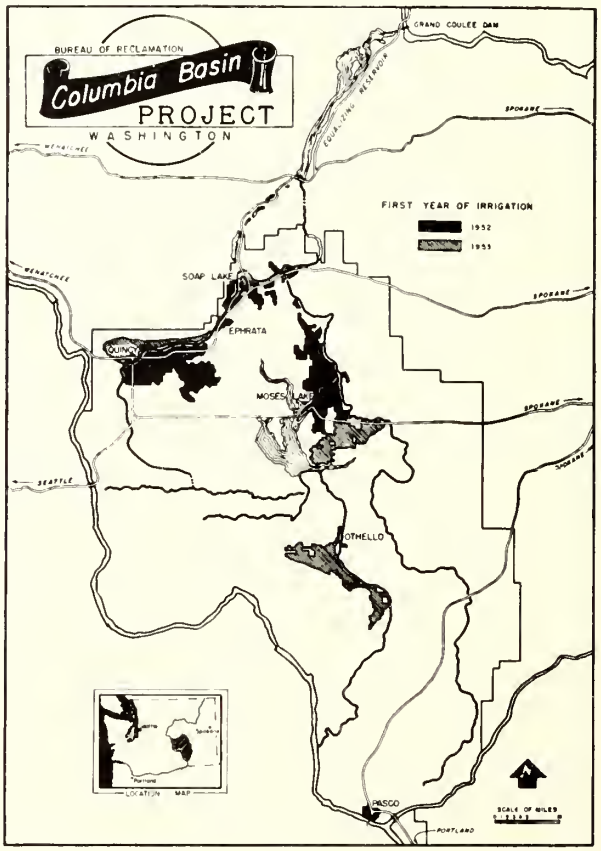
COLUMBIA BASIN PROJECT'S MILLION-ACRE DESERT cannot become an oasis overnight.

It will take about 15 years to construct canals and laterals for irrigating the first 500,000 acres. The end of construction will be only the beginning of a new phase in the development of this giant irrigation project. Many years of careful operation and maintenance will pass before the irrigation system is in full scale operating condition.

Of the 500,000 acres currently programmed for development, only about 67,000 acres at the northern end of the project could be served in 1952. During the next 8 years, as construction progresses, water will be made available to about 65,000 additional acres each year. Each new acre brought in must be taken through the maturing process. At the end of 10 years Columbia Basin project will be composed of areas in 10 different stages of the approach to maturity.

This is not the first year of irrigation operations on the project. Approximately 5,500 acres near Pasco, Wash. have been irrigated since 1948 by water pumped from the Columbia River. Another area of about 1,600 acres near Burbank, Wash., has been irrigated since 1950 by pumping from the Snake River. These areas served as a training ground for this first year of operation of the project's major gravity works. In these areas, proposed water allotment and charge bases have been tested, and costs of operation and maintenance in the project area have been under close study.

We were busy during the winter months getting ready for the beginning of large scale operations. Our first job was to select competent watermasters. With their help we picked and trained experienced operating personnel, equip-

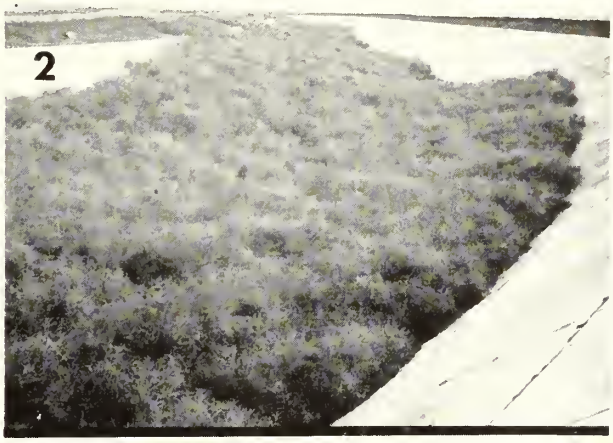


ment operators, and laborers. We had to acquire a variety of equipment necessary to effective operation and maintenance. We solved the problem of communications in the previously almost entirely untenanted area by installing a two-way radio system. We placed mobile sets in specified vehicles, a major fixed set at the project headquarters in Ephrata, and smaller fixed sets in the various Watermaster headquarters. We charted the timing and amounts of water diversions, and geographical progress of the testing operations in advance.

We set up an organization consisting of a Division headquarters at Ephrata and four Branch headquarters in the field. The Quincy and the Royal field branches will operate the Main and West canals; the Othello and Franklin branches will operate the East Low and Potholes East canals. Only the Quincy and Othello branches were active during this year's operations.

We now have 12 Watermaster sections set up to operate within the field branches, each section to serve about 50,000 acres of irrigable land. The Winchester, Adco, and Moses Lake Watermaster sections were put into action to serve those portions of the system being tested this year.

Within the Division Headquarters, we set up a Maintenance Engineering Branch, Hydrography Branch, Drainage Branch and Administrative Branch to continue working on the plans, to study



THE FIRST YEAR IS THE HARDEST

1. **STRONG WINDS AND DUST.**—Here is a lateral between Quincy and Winchester, almost obscured by dust. Because of the light powdery soil in parts of the Columbia Basin project, new farmers must keep it in control by wetting it down and planting fast as soon as they clear their land. *Photo by F. B. Pomeroy, April 30, 1952.*

2. **TUMBLING TUMBLEWEED.**— Russian thistle, filled the West Canal (large enough to carry the average flow of the Illinois River at Peoria) almost to the brim, creating another maintenance chore. *Photo by Dave Roderick, February 15, 1951.*

3. **REWARD FOR WORK.**—A successful crop of potatoes on a farm near Winchester, produced despite the difficulties of putting raw land into production, through the efforts of the farmers and operation and maintenance staffs. *Photo by F. B. Pomeroy, July 16, 1952.*

4. **AT THE "NERVE CENTER."**—E. H. Neal, author of this article, seeing to it that water gets to the farmers when they need it. *Photo by F. B. Pomeroy, May 9, 1952.*

the jobs being done and to be done, and to fulfill the immediate administrative requirements.

On March 10, 1952, the Watermaster opened the gates at Dry Falls Dam near Coulee City. Water flowed into the project's Main Canal, and the first season of large-scale irrigation operations began. The operating forces had quite a job laid out for them during the first season. They had to test about 100 miles of major canals and over 150 miles of laterals, as well as a number of relift pumping plants and mechanically operated control gates. We designated 1952 the official "Testing Year" for the portions of canals and the laterals being brought into operation. Actually this basic job was further complicated by the inrush of settlers to the basin's new farms. During the season, water was delivered for the first time to about 450 new farms.

Confining quantities of deep, swiftly flowing water within banks of dry earth, even when some of those banks are protected by linings, is a tricky business at best. Naturally, therefore, this first season's operations were closely and anxiously watched. Ditchriders patrolled major canals 24 hours a day. Equipment and men were kept ready, like a fire brigade, to concentrate at any point of need. However, in general the season passed with only the expected minor breaks, leaks, and washouts on smaller unlined laterals. Only one break of consequence occurred on the East Low Canal. Fortunately, crews were able to repair it swiftly and prevent significant damage to crops in that area.

The year was not without its problems, however. Service roads were inadequate for quick movement of equipment and men. Ditchbanks were dry and bare of vegetation. Delivery to new farms in some areas required increase of velocities and raising of water surfaces in laterals and canals beyond what was considered safe, and caused some scouring of the banks. An extended period of high winds in some areas produced erosion of newly tilled farm lands and unprotected ditchbanks. Canals and laterals were convenient catchalls for several varieties of rolling and tumbling weeds, which jammed structures and turnouts and increased the difficulty of water regulation and delivery. Thus a large part of the operating personnel were kept busy building and repairing roads, seeding ditchbanks to grasses, rip-rapping ditchbanks to prevent their washing away, sometimes reexcavating laterals filled with windblown soil, and repairing a variety of leaks and washouts.

Throughout the year the number of farms under development steadily increased. By the end of the season, more than half of the platted farm units in the areas for which water was available had received delivery of water. On about 450 farms, about 21,000 acres were actually cropped. Returns varied from complete failure (a small acreage) to over $1,000 per acre.

Columbia Basin farmers in the areas being tested this year, bought irrigation water by the acre-foot. The price varied, depending on the productivity rating of the lands within the particular farm. Each farmer could use as much or as little water as he wished. In the future, each water user, by paying the tax assessment for his farm, will be entitled to a base quantity of water. The amount will be figured on the estimated water requirement for lands in his particular farm. Additional water will be sold at rates which increase with each acre-foot per acre used.

In a few years, water lifted by pumps from the Columbia River at Grand Coulee Dam and impounded in the Equalizing Reservoir above Dry Falls Dam will be used to irrigate farm lands near Pasco, almost 160 miles from the big pumps. More than 7,000 new farms will be served by the East Low and West Canals, and by canals from the Potholes Reservoir situated in the center of the project.

This year has provided a preview of the requirements of future years. The irrigated areas will now grow at a predetermined rate, year by year. With the proper combination of men and machines for efficient maintenance, the giant irrigation system will provide efficient, economical service to thousands of farms—once wasteland. ###

BUILDING UP THE LEVEES.—*All photos for this article by Herbert Huffman, San Joaquin Valley District.*

AT CHOWCHILLA

How Local-Federal Cooperation Pays Off in Cutting Costs, Speeding Construction and Delivering Central Valley Project Water

by JUDGE H. V. EASTMAN,
Secretary-Manager, Chowchilla Water District,
Chowchilla, Calif.

ONE NIGHT IN THE SUMMER OF 1917 a serious group of landowners met in a country schoolhouse near Chowchilla, a farming community in the San Joaquin Valley of California.

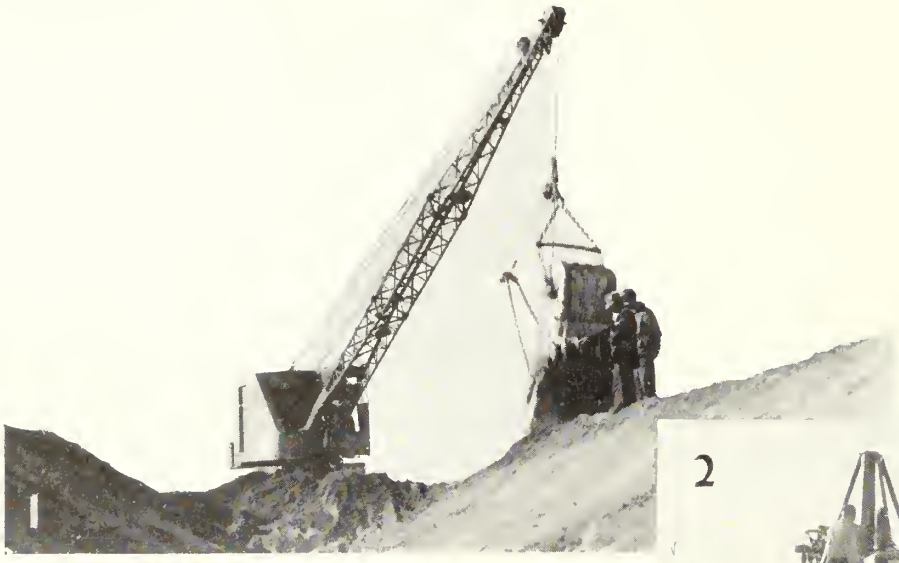
They met to discuss, and seek a solution to, a problem so vital that it threatened successful operation of their farms and the continued existence of their community. Chowchilla is in a semi-arid region with little winter rainfall and none in the summer. Crops must be irrigated repeatedly. Hundreds of wells, equipped with electrically operated pumps, were the sole source of water for domestic and irrigation supply.

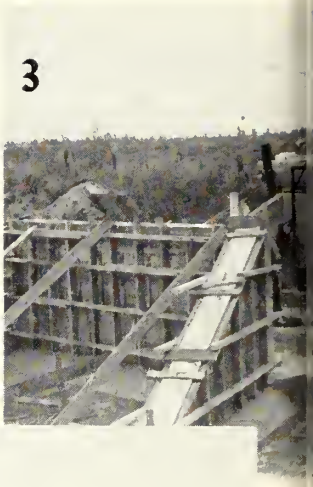
The meeting was called to consider the serious situation resulting from rapidly falling water levels in most wells, with the necessity of drilling deeper wells and installing larger pumps. Even these measures, which were costing the community more than a half-million dollars yearly, gave only temporary relief, as the underground water level continued to fall.

While supplemental water from the Central Valley project, then under construction by the Bureau of Reclamation, had long been heralded as a source of supply to save Chowchilla's farms, the chance that this added water might be received in time to bolster the community's sagging economy seemed remote. The farmers in that evening meeting knew that Chowchilla's lands were a part of the Madera Irrigation District. While the Madera district had entered a contract for Central Valley project water some 10 years earlier, a new water service contract must be negotiated and arrangements made for the construction of a distribution system to serve project water to the district's lands. The cost of the proposed system and differences of opinion were contributing to endless delays—delays which the Chowchilla area of the Madera district could not afford.

At the meeting it was brought out that water was then available at Friant Dam, some 40 miles to the south of Chowchilla, and that limited service could be obtained immediately through the project's Madera Canal, providing existing streams traversing the Chowchilla area could be used to distribute the canal flow.

Determining then that they must have earliest action, the farmers in that evening meeting resolved to solve their problems by cooperative action and appointed a committee of 25 to plan a program and hurry up the delivery of CVP water.





Duval Williams, a long-time advocate of the Central Valley project, was made chairman, and I. H. V. Eastman, the local judge, was appointed secretary. For nearly 2 years the committee worked on the problem and finally concluded that it would be necessary to get out of the Madera Irrigation District and form a new district if early results were to be obtained. The Madera district eventually would solve its problems, but water conditions at Chowchilla needed immediate action.

With general plans laid, more committee work followed. Money for expenses was raised by subscription, petitions to withdraw from the Madera district circulated, and other petitions, to form a new district, were signed by hundreds of property owners. Assurance of a water supply had to be obtained from the Bureau of Reclamation and definite plans made for distributing water to farm lands.

The Bureau was willing to build canals for the proposed district, but the committee decided upon locally-built and locally-financed canals and, because of the geography of the area, it has been possible to work out a unique plan of canal and lateral construction and operation, through cooperative action of individual farmers, landowner groups, improvement and water districts, which has brought adequate water to the Chowchilla community at minimum construction and operating costs.

The amazing spirit of unselfishness and cooperation of an entire community and the helpfulness of Bureau of Reclamation representatives have been important factors in solving the area's water problems and in achieving the substantial results which already have removed the threat which was hanging over the community only 5 years ago.

The Chowchilla Water District was organized in February 1949, embracing 63,000 acres of fertile farm lands. The district promptly negotiated a contract with the Bureau of Reclamation and, although just formed, was the first district in the valley delivering Central Valley project water.

The Chowchilla district was allocated 2 acre-feet of project water to supplement its existing underground supply. This is not enough for complete surface irrigation and it was planned that only about half of the land would receive canal irrigation. It was expected that with this land no longer depleting underground water, levels would

AT CONTRACT SIGNING: (Figure 6 at right) left to right, seated, Ralph M. Brody, Assistant Counsel (Bureau of Reclamation), Region 2; District Manager (B. of R.) Jack W. Rodner; Duval Williams, Chowchilla Water District; Regional Director (B. of R.) Richard L. Boke; Frank Justin, President, Chowchilla Water District. Standing, Attorney Denslow Green, Chowchilla Water District; Secretary H. V. Eastman; CWD Directors Charles Maylock, H. P. Dower and Mark Van Elswyk; B. of R. engineer Howard S. Stoddard.

rise promptly and the other half of the district would continue to use pumps, with improved water levels and lower pumping costs. Cost of water to the entire district would be as nearly as possible equal, with district taxes and water charges so fixed as to achieve this result.

Project water is received from Madera Canal of CVP into Ash slough, and from that stream, into Chowchilla River and Berenda slough. Both project water and natural flow are delivered in

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COOPERATION IN ACTION

UILDING A CANAL.—Twenty-eight own- 1,200 acres of land in the Chowchilla r District banded together to form an vement district and build this Justin Extension, which will carry 30 cubic of water per second to their properties. Water District operates the dragline. The ited farmers pay the costs through the vement district.

UYING A DITCHER.—Ten farmers pitched buy this elevating ditcher when farmer s in Chowchilla decided to build lat- to bring Central Valley project water the Chowchilla District's main canals to farms. After the first group used the r for their own lateral, they offered it of charge to other groups to use for ng canals in the district.

AVING MONEY.—When offers by con- rs for constructing a diversion works to ol the flow of water from Berenda Slough lifa Canal were too high, the District de- to build the structure with its own main- ce forces. They are completing the work e-half the cost offered by the contractors.

UILDING A DIVERSION DAM.—The chilla Water District just completed this structure, Chowchilla's main diversion which replaces sand dams formerly to divert and control the stream flow of chilla River and Ash Slough. Water these streams, supplemented by that ded by the Central Valley project, di- irrigates half the 63,000 acres in the t. The remaining half is watered by s from the underground reservoir which ing rapidly replenished now that CVP is available.

OOSTING THE COMMUNITY.—Decora- along the main street of Chowchilla, proclaim that the holiday season of is a happy one for a community which olved its water problems through coop- n.

AVING TIME.—Although the Chowchilla District was one of the last to be or- ed in the San Joaquin Valley, it was the o deliver Central Valley water.

these streams, which are used as main canals through the district. For many years these streams carried flooding mountain water, which built up plains, so that the stream beds are higher than surrounding land. Water is now diverted into lateral canals with sand dams of inexpensive structure. The main channels and diversion works were built by the district.

About 80 miles of canals tapping these streams have been built in 4 years by groups of farmers, sometimes with local equipment and at times by contractors. All construction costs have been financed locally and no public funds have been used. A variety of plans were used by the different farmer groups who built canals. In some cases all of the affected farmers have signed agreements to pay a proportion of the costs and to furnish canal rights-of-way without charge. Three mutual water companies were organized to build canals. Three improvement districts were formed to finance three canals. Some canals were built with only verbal agreements and no trouble has occurred as a result of these informal arrangements. All of the canals are now being operated and maintained by the Chowchilla Water District in order to assure uniform operation and care.

Practically all canal rights-of-way have been furnished without charge by landowners. The district furnishes engineering and legal help without charge to all groups who build canal laterals and will also arrange for construction funds when necessary. All concrete structures and most of the canals are of standard design. Howard A. Stoddard, formerly with the Bureau of Reclamation, is the district engineer. Canal costs have averaged less than $15 per acre for the entire district in a section where distribution systems are costing several times that amount.

Farmers Guarantee $50,000 In Advance

A highlight in the history of the district came when 25 farmers guaranteed payment for $50,000 worth of water for the entire community before the district was formed. Another time 10 farmers paid for a large elevating ditching machine and loaned the machine to any group who wanted to dig a canal.

Well measurements show that after operating for 4 years the underground water level has risen over more than 80 percent of the district—as much as 30 feet in some areas.

The district has carried on an extensive building program since the close of the 1952 irrigation season to provide permanent diversion dams to control the flow of water into the streams used as canals. This work is being done with local help or small contractors and the total cost will not exceed $40,000, which represents about 65 cents an acre for the district lands. The district is also helping to repair stream banks at points where winter floods may overflow them. These projects will complete all of the major improvements necessary to put this district in a sound operating condition.

Partly because of the cooperative spirit shown by landowners, the district has functioned with less difficulty than has appeared in some districts, and very few problems have developed in using Central Valley project water. The group of determined farmers who met in a Chowchilla schoolhouse in the summer of 1947 have carried forward a program, then sketchily outlined, which has ended the threat of water bankruptcy to their farms and their community. ###

Seeds of Wealth

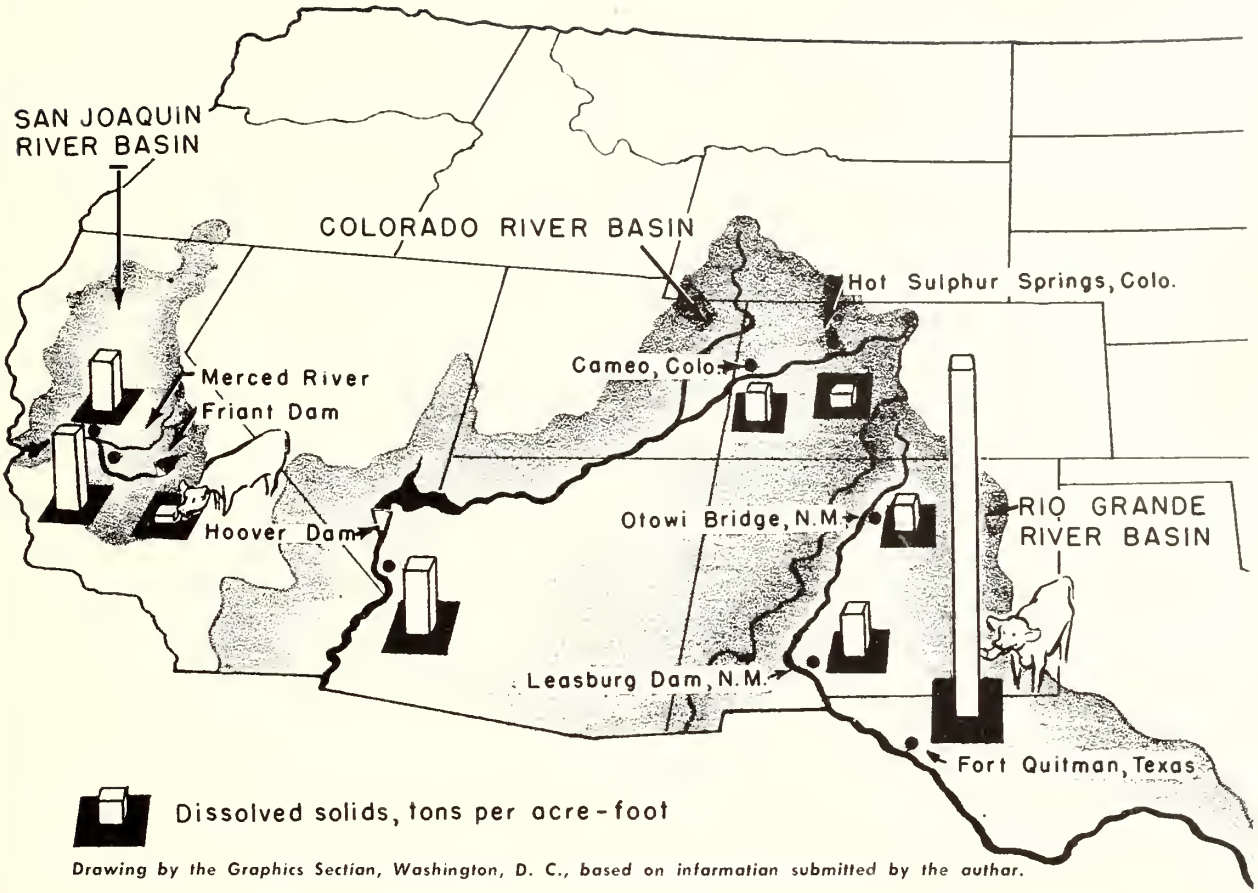
The contribution in indirect taxes made by lands on Federal Reclamation projects is well illustrated in a report by the Crookham Co. of Caldwell, Idaho, the Nation's largest producer of hybrid sweet corn seed.

The firm has engaged in seed production since 1930 when hybrid corn was first used. For the past decade approximately 4,300 acres annually have been planted to seed crops for the company. During this 10-year period the company has paid taxes of all kinds at the rate of $17 per acre each year, or a total of $731,000 for the entire area.

In addition to these payments, taxes are paid by the farmers on whose land the crops were grown, by the truckers, combine operators, and by the many service industries.

The Federal investment in facilities needed to serve the seed-producing land of the company amounts to between $450,000 and $475,000, all of which will be repaid by the water users, without interest.

The company president, G. L. Crookham, Jr., a great booster for expansion of irrigation says, "To be sure I don't like taxes any better than the next fellow. But tax money invested in Reclamation projects has proven to be a good national investment." •



Drawing by the Graphics Section, Washington, D. C., based on information submitted by the author.

IRRIGATION AND WATER QUALITY

Part 2—Quality of Water in Selected Basins

by C. S. HOWARD, Regional Chemist,
Quality of Water Branch, Geological Survey,
Salt Lake City, Utah

PRACTICALLY ALL STREAMS show a progressive increase in dissolved solids concentration from the headwaters to the mouth. Much of the increase is due to water coming in contact with natural, calcareous, or gypsiferous soils and dissolving large quantities of this material, thus increasing the hardness of the water.

Waters draining from a region with soils containing large quantities of soluble sodium salts will be less suitable for irrigation of certain soils because of changes in soil characteristics that affect the percolation of irrigation waters. The use of water for irrigation causes additional increases which may be of considerable importance.

When drainage and waste waters enter a full, flowing stream the incoming waters may be diluted. This dilution is needed as much for irrigation returns as it is for other types of wastes. The possibility of dilution will be less as more projects are developed and the water is reused over and over again. Water users along certain streams are concerned over the increasing practice of diverting water from the headwaters into another drainage basin. Although no computations have been made to show the changes that may be expected as a result of these diversions, it seems certain that significant effects on the water quality will result in basins where the water is used and reused many times.

The quality of certain waters in the State of Colorado in the early 1900's was discussed by Headden who showed that the supply for the city

of Fort Collins had quite a variation in dissolved solids concentration. The supply was from the Cache la Poudre River and during periods of low flow the water was largely seepage from irrigated lands. The Department of Agriculture has studied the quality of irrigation waters and the changes that take place in many irrigated areas. In these studies an attempt is made to determine the quantity of dissolved solids going into, and the quantity removed from, an irrigated area, for the computation of the "salt balance." The balance is said to be unfavorable when the quantity of salt that enters the project is greater than the quantity removed. Conversely, the balance is favorable if more salts are carried out of the project in the waters than was carried into the project. Such studies and computations are of importance to those using water in the area because the results indicate whether salts are accumulating in the irrigated lands. The results are also of importance in that they show the change in concentration and chemical character of the water available for irrigation and other uses downstream.

Recent studies in the Yakima Basin have shown a favorable salt balance for the Sunnyside District, but the analytical and computed results show that large quantities of dissolved solids are brought into the Yakima River as a result of irrigation practices. These solids will affect the usefulness of the waters of the Yakima and to a very slight extent the quality of the water of the Columbia River, to which the Yakima is tributary.

Large irrigation developments in the San Joaquin Basin in California use water from the San Joaquin River and some from the Sacramento River. Analytical results for the San Joaquin show considerable changes in the water quality with the concentration of dissolved solids increasing downstream. It appears that some of the tributaries (for example Merced River) may dilute some of the dissolved solids in San Joaquin River water. The presence of large areas in which there are appreciable quantities of soluble salts will be a source of soluble salts for the drainage waters from the land and for the waters of the stream.

For the Rio Grande the dissolved solids content of the river water increases progressively downstream and records of the Department of Agriculture show that the concentration of dissolved solids of the Rio Grande at Fort Quitman, Tex., is more than 16 times the concentration of dissolved solids in the river at the Otowi bridge; about 90 miles below the Colorado-New Mexico State line. For many years unfavorable salt-balance conditions have existed in parts of the Rio Grande Basin, but in 1949 due to increased rainfall, the salt-balance conditions were favorable throughout the basin.

In some developed areas in the Colorado River Basin, signs of accumulation of soluble salts because of poor drainage are visible and some tributaries bring in waters of relatively high concentration which are of no value for the dilution of drainage waters. The effects of storage in Lake Mead have been discussed previously, but it should be pointed out that Lake Mead, in addition to regulating the flow of water, also regulates water quality. Storage has decreased the range in concentration of dissolved solids of the water in the lower Colorado River. Much of the irrigation in the Lower Basin is done at a time when the normal stream flow is lowest and the mineral content of the water of the unregulated stream is highest. Storage has produced a fairly uniform concentration of dissolved solids, and the water users in the Lower Basin are now applying water with a lower average concentration of dissolved solids than that which they had before the river flow was regulated.

The possible effect on water quality through irrigation practices often has not been recognized, possibly because of the difficulty in determining actual changes due to irrigation practices. There are few legal documents that mention water quality, but it is likely that discussions leading up to the preparation of river compacts may have considered the effects of irrigation practices on water quality. It seems, however, that more information is needed concerning the effects of irrigation on water quality and steps should be taken to improve irrigation practices to lessen the harmful effects of such practices.

NEXT MONTH—

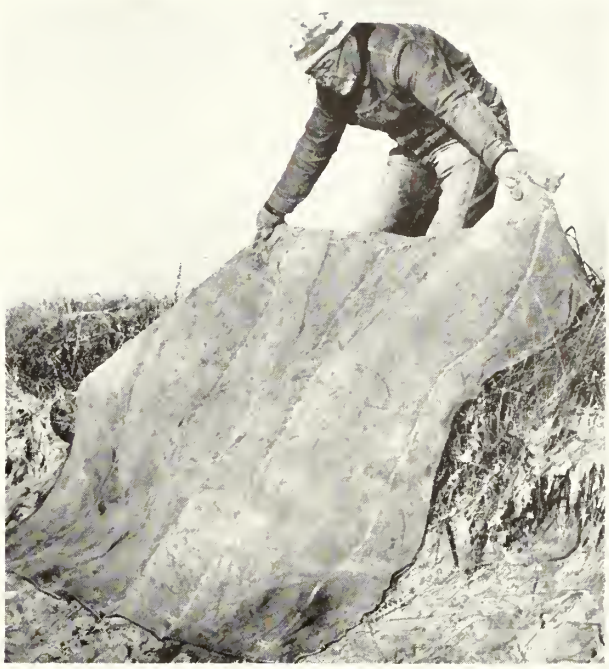
DON'T GAMBLE ON WATER QUALITY!

Plugging Holes With Canvas Dams

The unique emergency truck used by the Twin Falls Canal Co. in Idaho, as explained in a recent issue of the ERA, has its smaller counterpart on the Wilder Irrigation District of the Boise project.

Two of its ditchriders carry with them at all times a 6-foot square section of heavy dam canvas to plug leaks caused by gopher and badger holes, which are perpetual trouble spots on most reclamation projects. In the past year ditchrider William Lawler states he has used the canvas three times where shoveling dirt would not have stopped the break.

Lawler, a 32-year veteran on the job, explains that where the velocity of the water escaping through the break is fast, he drives sticks vertically into the ditch bank to prevent the canvas from being sucked through the hole. He does not recommend using rubberized canvas. It is too stiff. •



Nebraska-Bostwick Development Farm

(Continued from page 29)

ditcher is pulled behind a farm tractor to cut the laterals when and where needed. All of the farm laterals are temporary except on an 800-foot section which is on a 2 percent slope. A series of drop structures were used to bring the water down the slope without erosion. All temporary laterals were laid out on a grade of 0.05 to 0.10 feet per 100 feet in order to eliminate all but a few check dams and assure uniform operation of siphon tubes. Studies have been made by the Division of Irrigation, U. S. Soil Conservation Service Research, and the University of Nebraska to determine proper irrigation practices for this and similar farms in the Republican River Valley. This information is now being summarized and will be used by local technicians for making recommendations to farmers.

Briefly, the following irrigation principles were followed on the Stenson farm: (1) water applications were made when the top 4 feet of soil reached 50 percent of its available moisture. This was determined in the field by use of a soil auger; (2) the size of irrigation heads was varied to prevent erosion; (3) the initial irrigation head was set so that the water would reach the end of the run in one-fourth of the total time required for the irrigation application. The size of irrigation heads was cut back after water had reached the end of the run in order to prevent excessive runoff loss.

The corn was irrigated twice during the 1952 season, with a total application of 12 inches. Two inches of water were applied to the oats in June. Atlas sorgo received 16 inches of water in two applications.

In order for the public to have a chance to view the crops and receive first-hand information from the technicians, farm field days were held in 1951 and 1952. On September 10, 1952, approximately 250 farmers gathered at the Stenson farm. Specialized irrigation equipment was inspected in the morning. A lunch was served by the Superior Chamber of Commerce at noon. Immediately after lunch, a short speaking program preceded the field inspection of the farm. Five stops were established at points of interest on the farm, with a speaker assigned to each.

When Willard Stenson is asked, "Do you like irrigation?" he replies, "Yes, I like irrigation and it pays too. I can now follow a good soil improvement and fertilizer program on my farm without fear of drought. I would hate to go back to dryland farming after my experience with irrigation."

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NEW FACES FOR DAMS

by Lewis M. Ellsperman, Engineer,
Design and Construction Division, Denver, Colo.

BONNY TEST—The upstream face of the test embankment at Bonny Reservoir in Colorado. The dark material at left is asphaltic concrete; the lighter material at right is soil cement. *Photo by J. R. Benson, Denver, Colo.*

IT LOOKS LIKE A WASHING MACHINE on the outside. If you looked inside, you might be reminded of a Ferris wheel. But it is neither a domestic nor a recreational device. In the Bureau's testing laboratories in Denver, it provides a practical, economical way of finding satisfactory substitutes for the rock riprap customarily used to protect the slopes on the upstream faces of earth dams and embankments.

Traditionally, riprap—massive pieces of hard, durable rock placed over the slope to depths of 3 feet or more—is widely used on the upstream faces of earth dams for protection against wave action in the reservoirs and against other natural destructive forces. For dam faces on the Great Plains, rock riprapping must now be obtained from sources 50 or more miles away. At some sites, Reclamation would have to haul rock by train or truck up to 400 miles, making riprap an expensive part of dam construction. For example, on Bonny Dam, an earthfill structure on the Missouri River Basin project near the Colorado-Kansas border, about 500,000 tons of rock and gravel were quarried near Golden, Colo., trucked to Boulder, loaded on railroad cars, shipped to Burlington, Colo., and finally trucked to the dam. Transporting such materials 250 miles is extremely expensive.

Designing protective surfaces for the upstream faces, or slopes, of earth dams is a difficult task. These slopes go through continuous cycles of wetting and drying and freezing and thawing. They are steadily pounded by reservoir waves, and the grinding produced by sand in the wave-borne water all challenge the durability of even the strongest protective cover. The treble assault of weather, wind, and wave must be analyzed and evaluated in selecting proper protection for a dam's face.

The effect of waves on earth slopes and methods of predicting wave action have particularly occupied the attention of many scientists. Expensive machines costing hundreds of thousands of dollars have been built by other interested organizations to generate waves for use in studying the phenomenon of wave action in beach and channel erosion.

The Bureau's researchers in the bituminous laboratories needed some such machine to simulate wave action in their study of substitute materials for rock riprap. But the costs were prohibitive. Accordingly, they built their own wave-producing apparatus—not at the price of $400,000 that one large machine reportedly cost, but at the nominal price of $500.

This device is in effect a washing machine, not unlike that found in the average home. It is a compact unit—a watertight metal tank, about 4 feet square and 3½ feet high. Depth of water in the tank is held at 20 inches. A horizontal shaft extending through the tank at its midpoint is revolved by a small electric motor. The drive mechanism turns the shaft at 40 revolutions per minute. Three equally spaced steel rods, 30 inches long, are rigidly welded around the shaft. At-

tached to each rod are six brass holders which in turn hold the samples of asphaltic concrete being investigated. Thus, 18 specimens can be tested at one time. The brass holders are designed to permit rotation on the rods so that the faces of the specimens strike the water surface at any desired angle.

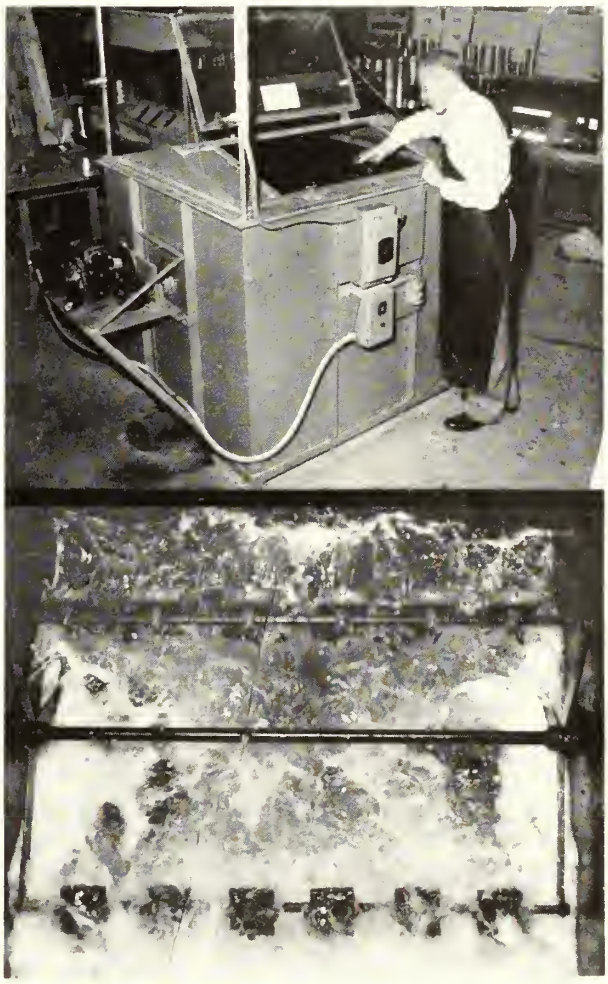
Asphaltic concrete is a mixture of asphalt and sand and a small amount of gravel, mixed hot at a temperature of about 300° F., compacted by heavy pressure, and then cooled. The end product is a tough, dense, impermeable, durable material. The asphaltic concrete specimens used in the laboratory are molded at a temperature of 265° F. on a hydraulic press; various loads for compaction are used to produce both high and low densities for each asphalt content. The sand and gravel used are obtained from deposits near the dam sites where asphaltic concrete may be used as a protective cover.

Specifically, the "washing machine" is used to evaluate the durability of specimens of asphaltic concrete under continuous spanking induced by the revolving mechanism. The machine operates on a 24-hour day, 7-day week basis. In a week's time it is possible to deliver approximately 400,000 blows to the specimens; a revolution counter attached to the shaft keeps an accurate account of the grueling punishment administered to the specimens. Certain samples tested have successfully withstood the steady pounding of 26,000,000 blows; other samples show considerable erosion and deterioration and have been rejected for use in construction.

Confirmation of the laboratory work is being carried out on a full-scale basis. A test section constructed on the shore of the Bonny Dam reservoir is faced with various thicknesses of asphaltic concrete previously studied in the laboratory. Local sand and gravel were utilized in the mix. (In the "washing machine" this material successfully withstood the effect of 7,000,000 blows.) The test section is being subjected to freezing and thawing, wind and wave action, reservoir drawdown, and other severe service conditions. So far, the asphaltic concrete test facing has been satisfactory. An alternative substitute facing, soil cement, is also being tested on the Bonny test embankment and is likewise showing promising results. (Soil-cement is a mixture of portland cement, soil, and a small amount of water for setting.) Like asphaltic concrete, soil-cement makes use of materials generally available at or near the site.

Because of good results in the use of asphaltic concrete as demonstrated by the laboratory experiments and by the Bonny test section, Bureau engineers have called for its application on Glen Anne Dam, an earth-fill structure on the Cachuma project in California. On the basis of alternative bids received, the cost of placing asphaltic concrete was $26,000 less than the cost of furnishing and placing riprap on the upstream face of the dam.

Water users can now look forward to major economies in earth dam construction throughout many areas of the west where rock riprap is at a premium. ###



PRE-TESTING SUBSTITUTES FOR ROCK RIPRAP.—At top, engineer L. M. Ellsperman places an asphaltic concrete specimen in the "washing machine." After the specimens have been assembled, the glass top is closed, and the electric motor, at left, is started up. Immediately above, an inside view of the full fury of wave action in the laboratory-built testing machine. *Both photos by W. M. Batts, Denver, Colo.*

DOUGLAS McKAY—

The New Secretary of the Interior

Douglas McKay, the new Secretary of the Interior, is not new to public service, having been elected Mayor of Salem, Oreg., for a 1-year term of office in 1933, Oregon State Senator for four terms of 2 years each (1935–37; 1939–41; 1943–45, and 1947–49), and Governor of the State of Oregon since 1949. He has also served as a first lieutenant in the infantry, Ninety-first division, during World War I, being decorated with the Purple Heart for wounds received in France, and as a captain and major in the Service Command Unit during World War II.

Born in Portland, Oreg., June 24, 1893, he lived in Portland's Albina district as a child, moved to Castle Rock, Wash., where he entered school, but returned to Portland to begin the third grade. He began to work to support himself at the age of 13, working his way through Lincoln High School and Oregon State College by selling candy, newspapers, driving a butcher wagon, working as a janitor, an office boy for the Union Pacific Railroad, and an agent for a laundry. He found time to be president of his freshman class and was graduated from College in 3 years, receiving his B. S. degree in agriculture in 1917.

For 7 years (1920–27) he worked as an automobile salesman and sales manager in Portland, and established his own automobile business in 1927.

Long before he sought public office Secretary McKay began working for northwest development. Almost as soon as he was elected to the State Senate he was appointed to the Willamette Valley Basin commission which concerned itself with valley flood control and irrigation. Many of the committee's recommendations have been embodied in the Federal Willamette Valley projects which are designed to alleviate damage from annual floods which wash away precious topsoil from verdant valley farms. As State Senator, Douglas McKay also was chairman of the committee on roads and highways. He was a member of the Port of Portland development committee although a Salem resident. As Governor, he regularly attended the meetings of the Columbia Basin Inter-Agency Committee, taking an active part in the discussions and seeking compromises between divergent interests on controversial issues.

The McKay family has lived in Oregon more than 100 years. The new Secretary is the son of E. D. McKay and Minnie A. Musgrove McKay. He married Mabel Hill on March 31, 1917, and has two daughters, Mrs. Wayne Hadley and Mrs. Lester D. Green. He is a member and past

president of the State Automobile Dealers Association, member and past president of the Salem Chamber of Commerce, member and past president of the Oregon State College Alumni Association, member of the Veterans of the Foreign Wars, Sons of the American Revolution, Disabled American Veterans, the Masons, Eagles, Elks, and Phi Delta Theta.

Upon learning of Governor McKay's designation as Secretary of the Interior, Oscar L. Chapman wrote on November 24, 1952, as follows:

"My Dear Governor McKay:

"I was very glad to learn of President-designate Eisenhower's intention to appoint you as the new Secretary of the Interior. It was particularly satisfying to me to know that my successor will be someone who is as thoroughly acquainted with the problems of the West, and who has the deep interest in the conservation and development of the Nation's natural resources as I know you have.

"I want you to know that it is my desire to do everything I can to facilitate the orderly transition of the responsibilities for the work of the Department from my hands to yours. The facilities of the Department are available to you for this purpose, and I shall be very happy to sit down with you, or with whomever you designate, at a time of your choosing, in order to discuss these matters.

"Again accept my heartiest congratulations on your designation.

"Oscar L. Chapman,
Secretary."

Governor McKay replied on December 1, 1952:

"Dear Secretary Chapman:

"Your kind letter of November 24 and your recent telephone call are sincerely appreciated.

"The friendly offer of cooperation and assistance in effecting the transition of the responsibilities for the work of the Department of Interior is a valuable contribution in my assumption of the position. I am looking forward to the opportunity to have an extended conversation with you as soon as the time element can be worked out to our mutual convenience.

"Thank you again for your thoughtfulness and for your good wishes on my appointment.

"With kindest personal regards, I am

"Sincerely yours,

"Douglas McKay,
Governor."

The new Secretary arrived in Washington, D. C., on January 7, 1952, to confer with members of Congress, Oscar L. Chapman, Interior Department officials, and others concerned with the transfer of functions to Secretary of the Interior Douglas McKay. ###

Sargent Looks Ahead

(Continued from page 31)

Promotion Club. Most of the members contributed $100 each to promote the irrigation interests of that general area. This group in 1944 requested the Bureau of Reclamation to make a detailed investigation of the potentialities for developing the water resources of the area.

As a result of detailed planning studies, a plan is proposed for development under the Sargent Unit of the Missouri River Basin project. This plan would provide for the irrigation of 17,560 acres of irrigable land and for the average annual generation, over a 50-year period, of more than 26 million kilowatt-hours of electrical energy, utilizing the direct flow of the Middle Loup River. Features to be constructed include the Milburn Diversion Works, Sargent Canal, Lillian Canal, Lillian Hydro-electric Plant, and the Sargent and Lillian distribution and drainage systems. The initial construction would include the Milburn Diversion Dam, Sargent Canal, and related distribution and drainage features to irrigate 13,740 acres of land located along the north side of the Middle Loup River from Milburn to the Custer-Valley County line.

"We can't afford to further delay or lose this opportunity for developing our resources," says Mr. Semler. Irrigation water on the initial 13,740 acres in 1952, if all in corn and at current prices, would have produced and increased gross return over dryland production equal to 75 percent of the current estimated construction cost of the distribution and drainage works. Annual benefits under full development would accrue directly to the water users in the form of increased cash returns and an accumulation of equity in the farm investment. Indirect benefits would also accrue to non-water users in Sargent and the surrounding trade territory in the form of increased profits to retailers, wholesalers, processors, and all other enterprises handling goods and services resulting from increased agricultural production. Addi-

tional population and increases in total assessed valuation of property would facilitate the provision of improved community facilities and services. The economic status of the businessman in town as well as that of the farmer would become more stable.

Having recognized the tremendous benefits that can be created through the development of irrigated lands, there is no doubt as to the course of action that should be followed. Farmers and businessmen alike have been sharing the responsibility of bringing water into use on the Sargent lands. Approval for the formation of the Sargent Irrigation District was granted by the landowners in the November 1952 election. This district is recognized as a legal entity for contracting with the United States Government for development of the project. Upon completing negotiations for a repayment contract and receiving the "go-ahead signal" from the Congress, a dream of wise water resource development will come true for the local people, and they can take their place as a comunity that has felt the magic touch of water and the pulse of economic and social well-being that accompany it. ###

Four-States Irrigation Council Meets

The Four-States Irrigation Council which was formed last January (see page 66 of the March 1952 Reclamation Era) held its second annual meeting on January 14–15 at Fort Collins, Colo. Operators of all irrigation and hydroelectric systems in Colorado, Wyoming, Kansas and Nebraska were invited to attend. The Era hopes to have the privilege of publishing more news about this progressive group. •

Klamath Settlement Announced

Approximately 6,700 acres of the 59,000-acre public land area which lies both in the Klamath and Tule Lake Wildlife Refuges and the Klamath irrigation project in Oregon and California will be opened for homesteading as soon as possible, in accordance with a directive from the Secretary of the Interior to the Bureau of Reclamation and the Fish and Wildlife Service early in January.

The balance will remain in wildlife refuges not subject to homesteading. Twenty-five hundred acres of the land to be homesteaded lie in California, near the town of Tule Lake. The remaining acreage is in Oregon just north of the State boundary.

There have been competing demands (a) for the opening of these public lands for homesteading under Reclamation law, as the lands involved are among the finest public lands for agricultural purposes under irrigation in the West and (b) for retention in public ownership since these lands are considered by some conservation interests to be indispensable for the maintenance of the Pacific Flyway, the area being one of the key waterfowl concentration points on the North American Continent.

The Secretary's directive provides for mutual cooperation and further investigations for the development of additional irrigated lands so that waterfowl conservation areas and homesteading opportunities can both be augmented.

By January 1, 1954, the Fish and Wildlife Service will take over the administration of lands in the Tule Lake and Lower Klamath Refuges which are now administered by the Bureau of Reclamation and which are not to be opened for homesteading. Leases of these lands are to be on a cash basis with careful attention to avoid land monopoly or corporate farming.

The Bureau of Reclamation is to continue leasing its lands in the area until December 31, 1953. •

Atomic Energy Commission Releases Part of Wahluke Slope for Reclamation

Early in January 1953, the United States Atomic Energy Commission announced it would release from restriction about 87,000 acres of land on the Wahluke slope across the Columbia River from its Hanford production plants.

The Commission accompanied its announcement with a warning that its action does not mean that all risk to life and property in the released lands has been eliminated, and at the same time reaffirmed its objection to farm settlement in the remainder of the area. For safety reasons, the Commission stated that no towns or cities should be established within 25 miles of the Hanford reactor area.

The lands released from restriction by the Commission comprise about 62,500 acres at the east end of the slope, including 23,000 acres under the Potholes east canal which will enable the Bureau of Reclamation to examine the irrigation service possibilities from that canal. The newly released area also includes approximately 24,500 acres at

the extreme west end of the slope. It is estimated that the Commission's action will permit the Bureau of Reclamation to consider the irrigation of about 40,000 acres susceptible to crop production. •

Admission Fee at Grand Coulee and Hungry Horse

Visitors taking guided tours through Grand Coulee Dam in the State of Washington and Hungry Horse Dam in Montana will be charged a small admission price in 1953 as a means of repaying the Federal Government for the costs incurred. The price schedule will be the same as at Hoover Dam which is: Adults, 25 cents plus 5 cents Federal tax; military personnel (in uniform) 5 cents tax only; children under 12, free. Educational groups, such as high school classes and Boy Scouts will be admitted free when they come in a body, give advance notice of their proposed visit, and adjust the visit to the Bureau's convenience. •

More Columbia Basin Farms for Veterans

Friday, February 27, 1953, is the deadline for filing an application for one of the 11 family-size farm units near Quincy, Wash., on the million-acre Columbia Basin project.

Veterans of World War II will have priority in applying for the farms, located approximately 135 miles southwest of Spokane. The farms, varying in size from 55 to 143 irrigable acres, are priced from $1,238.70 to $2,122.

Applicants are required to have 2 years of full-time farming experience after 15 years of age and must possess at least $4,500 in assets to develop their unit. Veterans are not required to send in their discharge papers when they file their original applications with the Bureau of Reclamation office at Ephrata, Wash., where application blanks and additional information may be obtained. •

NOTES FOR CONTRACTORS

Contracts Awarded During December 1952

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DS-3778	Palisades, Idaho	Dec. 22	One 150-ton traveling crane for Palisades power plant.	Moffett Engineering Co., Albany, Calif.	$85,385
DS-3795	Missouri River Basin, S. Dak	Dec. 8	One 20,000/15,000/20,000-kva transformer for Rapid City substation, schedule 1.	American Ehn Corp., New York, N. Y.	83,800
DS-3795	do	do	One 115,000-volt circuit breaker for Rapid City substation, schedule 2.	Westinghouse Electric Corp., Denver, Colo.	23,950
DC-3804	Yakima, Wash	Dec. 15	Furnishing and installing two 4,160-volt generators for Chandler power plant.	Electric Machinery Mfg. Co., Minneapolis, Minn.	284,093
DS-3805	Yakima, Wash	do	Two 8,500-hp. and two 2,600-hp. vertical-shaft hydraulic turbines for Chandler power and pumping plant, schedules 1 and 2.	James Leffel and Co., Springfield, Ohio.	412,46
DS-3805	Yakima, Wash	Dec. 23	Two vertical-shaft centrifugal pumps for Chandler power and pumping plant, schedule 3.	Worthington Corp., Harrison, N. J	69,455
DS-3810	Columbia Basin, Was	Dec. 24	Remote control and telemetering equipment for the bifurcation works and Adco watermaster's office.	Control Corp., Minneapolis, Minn.	14,260
DC-3816	Weber Basin, Utah	Dec. 10	Construction of Gateway tunnel	Utah Construction Co., Salt Lake City, Utah.	2,486,613
DC-3819	Colo.-Big Thompson, Colo	Dec. 29	Installation of supervisory control and telemetering equipment at Granby and Willow Creek pumping plants and Willow Creek dam	David Rietveld, Fort Collins, Colo.	13,880
DC-3822	San Diego, Calif	Dec. 15	Construction of earthwork, pipe line, and structures for San Jacinto-San Vicente aqueduct.	S. A. Healy Co., Chicago, Ill	6,798,101
DS-3823	Central Valley, Calif	Dec. 17	Two switchgear assemblies for Nimbus power plant.	I-T-E Circuit Breaker Co., Philadelphia, Pa.	32,700
DC-3831	Missouri River Basin, S. Dak	Dec. 9	Construction of Missouri River crossing for Oahe-Midland 115-kv transmission line.	R. N. Campsey Construction Co., and C. F. Lytle Co., Denver, Colo.	115,615
DC-3832	do	Dec. 23	Construction of 115-kv and 230-kv transmission line approaches into Fort Randall switchyard.	Hallett Construction Co. and Continental Co., Crosby, Minn.	168,095
DC-3834	Cachuma, Calif	Dec. 18	Construction of Ortega and Carpinteria reservoirs and control stations.	Wonderly Construction Co., Long Beach, Calif.	939,003
DS-3835	Palisades, Idaho	Dec. 22	Two 19.67-foot by 28.03-foot fixed wheel gate frames for outlet and power tunnels at Palisades dam and power plant.	Valley Iron Works, Yakima, Wash.	52,800
DC-3836	Gila, Ariz	Dec. 17	Construction of earthwork, concrete lateral lining, and structures for Unit 3 of Mohawk distribution system.	Peter Kiewit Sons' Co., Arcadia, Calif.	1,682,673
200C-201A	Central Valley, Calif	Dec. 16	Recorder houses and measuring wells for Friant-Kern Canal.	A. C. King, Inc., Fresno, Calif.	16,942
200C-222	Cachuma, Calif	Dec. 9	Fencing Glen Anne reservoir site	Los Angeles Fencing Co., Inc., Los Angeles, Calif.	10,835
200C-223	Central Valley, Calif	Dec. 4	Constructing and modifying turnouts, station L-648 to station 3715, Delta-Mendota Canal, schedule 1.	Stanley H. Koller Construction, Crockett, Calif.	85,285

NOTES FOR CONTRACTORS—Contracts Awarded During December 1952 (Continued)

Spec. No	Project	Award date	Description of work or material	Contractor's name and address	Coutrat amount
200C–223	..do..	..do..	Coustrueting and modifying turnouts, station L–648 to station 3715, Delta-Mendota Canal, schedule 2.	A. C. King, Inc., Fresno, Calif.	12,998
300C–44	Parker Dam Power, Ariz.-Calif	Dec. 1	Elementary school at Parker Dam Government Camp.	Pritchett Construction Co. Provo, Utah.	99,806
500C–28	Middle Rio Grande, N. Mex.	Dec. 3	Buildings and utilities for maintenance headquarters at San Marcial.	The Barnes Co., Inc., Albuquerque, N. Mex.	62,989
603C–26	Missouri River Basin, N. Dak.	Dec. 9	Clearing areas of Jamestown reservoir	Brasel and Whitehead, Riverton, Wyo.	73,750

Construction and Materials for Which Bids Will Be Requested by April 1953

Project	Description of work or material
Boulder Canyon, Ariz.-Calif.-Nev.	Construction of 10 miles of concrete pipe laterals, 4 pumping plants of 59 to 8 cubic feet per second capacities, and 2 equalizing reservoirs to serve about 2,500 acres for part 2 of unit 8, Coachella distribution system, adjacent to the Coachella canal southwest of Indio, Calif.
Central Valley, Calif.	Construction of laterals for the north section of Madera distribution system's unit I near Madera, Calif., comprises 32 miles of laterals varying in bottom width from 6 to 18 feet.
Do	Construction of 8 power turnouts of 2 to 9 cubic feet per second capacities, 3 gravity turnouts, and 20 laterals consisting of 10 miles of 12- to 30-inch diameter concrete pipe for Plainview Water district distribution system on the Delta-Mendota Canal about 2.5 miles southwest of Tracy, Calif.
Do	Unit 2 of Delano-Earlimart irrigation district distribution system on Friant-Kern Canal, located in Tulare and Kern Counties near Delano, Calif., is to include in construction 64 miles of 12- to 69-inch diameter reinforced concrete pipeline, monolithic concrete moss screens, the 170 cubic feet per second outdoor-type pumping plant D–3, and other smaller plants and highway and railroad crossings.
Colorado-Big Thompson, Colo.	Coustruction of 16.5 miles of 200 cubic feet per second Boulder Creek supply canal, an earth structure to convey water from the St. Vrain supply canal to Boulder Creek. Coustructiou will include such structures as siphons, flumes, drops, bridges, and turnouts. Located between Lyons and Boulder, Colo.
Do	Construction of parshall flume and installation of staff gages on three dams in the Flatiron area, 5 miles west of Loveland, Colo.
Do	Installation of overhead ground wire on Greeley-Brush transmission line and alterations to overhead ground wire on Estes-Flatiron transmission line.
Columbia Basin, Wash.	Constructing a 1,600-foot earth dike, 5 to 16 feet high; erecting a pumping plant and installing two Government furnished pumping units; and furnishing and laying 1,100 feet of 18-inch high-pressure concrete pipeliue for the utilizatiou of wastewater from Babcock puuping plant, W8 lateral system ou West canal.
Do	Constructiou of 34-mile unlined reach of East Low canal, south from Warden, Wash., varying in capacity from 1,490 to 550 cubic feet per second and in base width from 22 to 20 feet. Major structures are 3 13-foot diameter monolithic siphons, 3 checks, 3 railroad bridges, wasteway turnout, 2 chutes and stilling pools, a uonolithic railroad culvert, and 15 timber county road bridges. About 4,000,000 cubic yards of common excavation and 270,000 cubic yards of excavation are required.
Do	Construction of 60 miles of laterals of 12 to 2 cubic feet per second capacity, 6 miles of wasteways, and five outdoor type pumping plants for the P–9 Area on Potholes East canal. Located 10 miles north of Richland, Wash.
Do	Sealing of about 2 miles of unlined canal prism on Potholes East canal's third section will consist of excavating, replacing with select compacted material, and covering with a gravel blanket.
Do	Drilling test wells for groundwater observations in lateral Areas W–6A, E–4, W–8, P–3, and P–8.
Do	Fabricated galvanized structural steel (about 200,000 pounds) for bolted switchyard structures for 287-kilovolt autotransformer installation at right switchyard, Grand Coulee power plant.
Eden, Wyo.	Construction of Prospect diversion dam and canal, near Farson, Wyo., will include 225 feet of earth dike, a rock weir 4 feet high and 70 feet long, and 0.5 mile of 150 cubic feet per second Prospect canal.
Eden, Wyo.	Construction of Eden canal's 4-mile second section is to include 1 mile each of 300 and 150 cubic feet per second capacity and 2 miles of 260 cubic feet per second partially earth-lined canal, and an additional 4 miles of 40 to 6 cubic feet per second Eden laterals E–7, E–11, and E–12. About 259,000 cubic yards of excavation are required. Work is located about 44 miles northwest of Rock Springs, Wyo.
Gila, Ariz.	Construction of 2.4 miles of 220 cubic feet per second Dome canal and 2.6 miles of 100 cubic feet per second lateral D–1.4E, near Dome, Ariz.
Do	Construction of 22 miles of unreinforced concrete lined laterals and sublaterals of 45 to 15 cubic feet per second capacities for Unit 4 of Mohawk distribution system near Wellton, Ariz.
Kendrick, Wyo.	Construction of a ditchrider's nonmodern house, 1 mile south of Casper Canal and 4 miles east of Poison Spider Creek siphon; and repairing a house at Alcova Dam government community.
Do	Repairing and widening banks and placing compacted earth lining on 0.4 mile of Casper Canal in Natrona County, Wyo., about 26 miles southwest of Casper.
Missouri River Basin, Mont.	Crow Creek 100 cubic feet per second pumping plant to be constructed about 4 miles southwest of Toston, Mont., on the Missouri River will lift water from the river an average of 176 feet through a 1,180-foot-long, 52-inch inside diameter steel pipe discharge line to Toston tunnel for gravity flow to Tostou and Lombard Canals. The indoor-type plant is to have a reinforced conerete substructure and a contractor-furnished superstructure 23 by 60 feet in area and 25 feet high. The contract is to include installing 3 Government-furnished 33.3 cubic feet per second pumps driven by 900-horsepower motors and an 8-ton single I-beam manually operated crane. Toston tunnel and a small reach of canal at tunnel outlet are under construction, but construction of 7.5 miles of 100 to 35 cubic feet per second Toston Canal and wasteway, 3 miles of 60 to 20 cubic feet per second Lombard Canal and wasteway, and lateral and drainage systems are required in this contract.
Do	Three oil pressure, cabinet-type actuator governors for regulating the speed of three 8,400-horsepower hydraulic turbines for Little Porcupine power plant.
Do	Three 32- by 20-foot radial gates for Tiber Dam.
Missouri River Basin, Nebr.-Kans.	Construction of 18 miles of unlined laterals and appurtenant reinforced concrete structures for Franklin canal's first section near Franklin, Nebr., requires 90,000 cubic yards of excavation.
Do	Construction of 11 miles of unlined Naponee Canal, laterals, drains, and appurtenant reinforced concrete structures, requiring 200,000 cubic yards of canal, lateral, and drain excavation and about 8,000 feet of 18- to 28-inch diameter concrete pipe.
Missouri River Basin, N. Dak.	Raising about 0.5 mile of Buehanan Road and surfacing with gravel and constructing a bridge over the James River, and raising and gravel surfacing about 1 mile of the Edmunds Road, and raising present steel truss bridge over the James River in the Jamestown Reservoir area.
Do	Extension of the Garrison-Bismarck double-circuit 230-kilovolt transmission line iuto the Garrison switchyard, and the Willistou-Garrison 115-kilovolt transmission line into the Garrison switchyard requires placing footings, erectiug about 20 Government-furnished steel towers, furnishing materials and stringing alumiuum conductors and steel overhead ground wires.

Construction and Material for Which Bids Will Be Requested by April 1953 (Continued)

Project	Description of work or material
issouri River Basin, S. Dak.	Construction of 20,000-kilovolt-ampere Rapid City substation near Rapid City, S. Dak., involves furnishing and erecting low voltage steel structures, erecting 115-kilovolt steel structures, and a 24- by 50-foot steel control building, and installing Government-furnished electrical equipment which includes one 20,000-kilovolt-ampere, 3-phase transformer; 115-, 25.2-, and 4.16-kilovolt bus structures, circuit breakers, and switching equipment; one 10,000-kilovolt-ampere synchronous condenser, and a 200-kilovolt-ampere distribution transformer.
Do	Construction of 66,667-kilovolt-ampere Sioux City substation near Sioux City, Iowa, involves furnishing and erecting steel structures and a 24- by 44-foot prefabricated steel control building, and installing Government-furnished elecfrical equipment which includes one 40,000/53,333/66,667-kilovolt-ampere, 110- to 69-kilovolt auto-transformer, and 230- and 69-kilovolt circuit breakers and diseonnecting switches, and a 69-kilovolt voltage regulator.
Do	Second stage construction of the Brookings, Groton, and Summit substations will consist of placing concrete footings and installing Government-furnished power transformers and autotransformers.
Do	Second stage construction of the Armour, Beresford, Flandreau, Tyndall, and Woonsoeket substations, in eastern South Dakota, will consist of furnishing and erecting structural steel bus structures and supports, installing Government-furnished control cable, power and autotransformers ranging in size from 5,000- to 20,000-kilowatt-amperes, 34.5-kilovolt interrupter switches; instrument transformers; additional sections of control boards in existing service buildings; and 12- and 34.5-kilovolt voltage regulators. Concrete footings will be required.
issouri River Basin, Wyo.	Construction of fencing, bank protection, jetties, and revetment work for soil and moisture conservation on the Five Mile and Muddy Creeks, near Riverton, Wyo.
Palisades, Idaho	Relocation of 5.5 miles of State Highway 29 (U. S. 26) about 62 miles southeast of Idaho Falls, Idaho, from Big Elk Fill to Indian Creek near Palisades Reservoir. About 1,200,000 cubic yards of excavation are involved.
Paonia, Colo	Placing about 1 mile of concrete canal lining on scattered 250- to 1,400-foot long reaches on the 30-mile course of Fire Mountain canal. The canal is located on higher ground along Colorado Highway 135 running from Paonia to Hotchkiss, Colo.
Riverton, Wyo	Furnishing and placing asphalt membrane lining in selected reaches of the Wyoming Canal near Riverton, Wyo., between stations 1606 and 2560.
Shoshone, Wyo	Lining of approximately 7,000 feet of Lateral R-4-S having a capacity of 49.9 to 73.0 cubic feet per second Heart Mountain division. Estimated 23,000 square yards of asphalt membrane lining required.
Solano, Calif	Construction of 260,000-cubic-yard concrete arch Monticello Dam, about 295 feet high above foundation and 1,000 feet long at the crest, with glory-hole type spillway and penstock-type outlet works, located on Putah Creek, 39 miles west of Sacramento, Calif. The spillway will have a 72-foot diameter uncontrolled crest and a 28-foot diameter outlet tunnel. The outlet works will consist of two 90-inch penstocks through the dam with valve controls. Conerete will require 1,500,000 pounds of reinforcing steel. In addition, the contract is to include a 500-foot long concrete highway bridge and a 400-foot long timber bridge cver Putah Creek and 2.5 miles of heavy highway construction. Bridge roadway widths are 26 feet for concrete and 24 feet for timber. The conerete bridge will have concrete abutments, nine piers, and nine 55-foot spans; the timber bridge will have timber bents and conerete footings.
Yakima, Wash	Construction of 6.6 miles of 435 cubic feet per second Chandler irrigation canal and 0.6 mile of 435 cubic feet per second wasteway for the canal's first section, near Prosser, Wash.

United States Department of the Interior, Douglas McKay, Secretary

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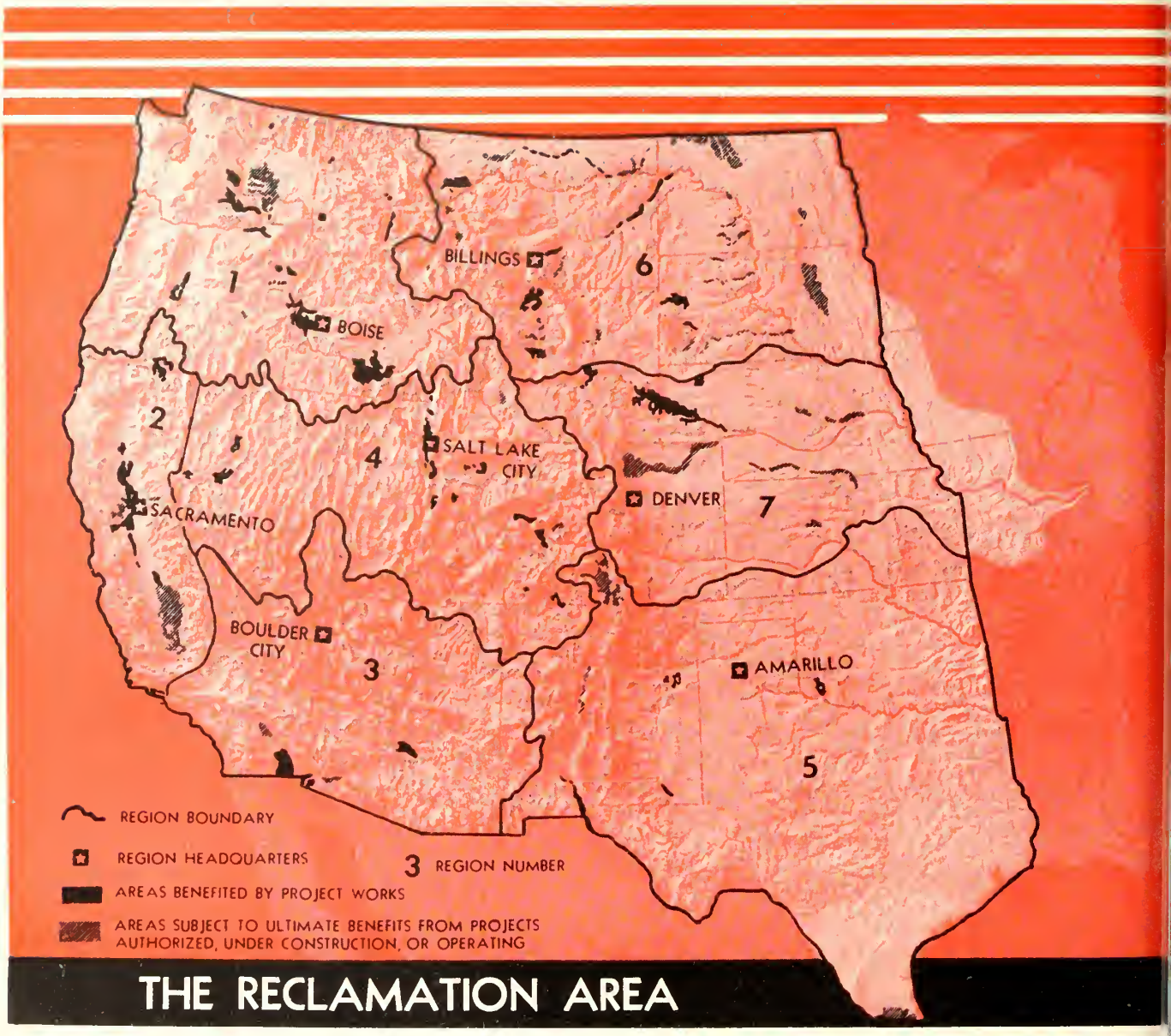

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The Reclamation Era

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March

1953

IN THIS ISSUE:

March 1953

Volume 39, No. 3

The Reclamation ERA

35 Years Ago In The Era

CROP ROTATION

Every farm should have a well-defined system of crop rotation. The object of crop rotation, if properly arranged, is twofold. Each crop should leave the ground in better condition for the next crop than it was before, and each crop should prevent the propagation and development of plant pests. The fallacy that sugar beets injure the soil has not only been exploded but just the reverse has been found to be the fact. It is true that sugar beets take out of the soil the same elements that are removed by other crops, but in slightly different proportions. But, as has been stated, a large part of these mineral elements is in the top, which, if properly handled, will be returned to the soil in the form of manure, so that in the end but little plant food is removed from the soil by the beet crop.

(From an article on page 99 of the March 1918 issue of the RECLAMATION RECORD, predecessor to the RECLAMATION ERA.)

OUR FRONT COVER. PRIMING SIPHONS. Hersey B. Roberts of the Riverton project in Wyoming demonstrates one way of priming a siphon tube. The October 1949 and December 1951 issues of the RECLAMATION ERA described other methods. If you have any better ideas, send them in. *Photo by Thomas R. Broderick, Region 6 photographer.*

OUR BACK COVER is based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners Kittredge and Coolidge.

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R. F. Sadler, Editor

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In this issue . . .

RECLAMATION PLACE NAMES IN THIS ISSUE

The Reclamation Era

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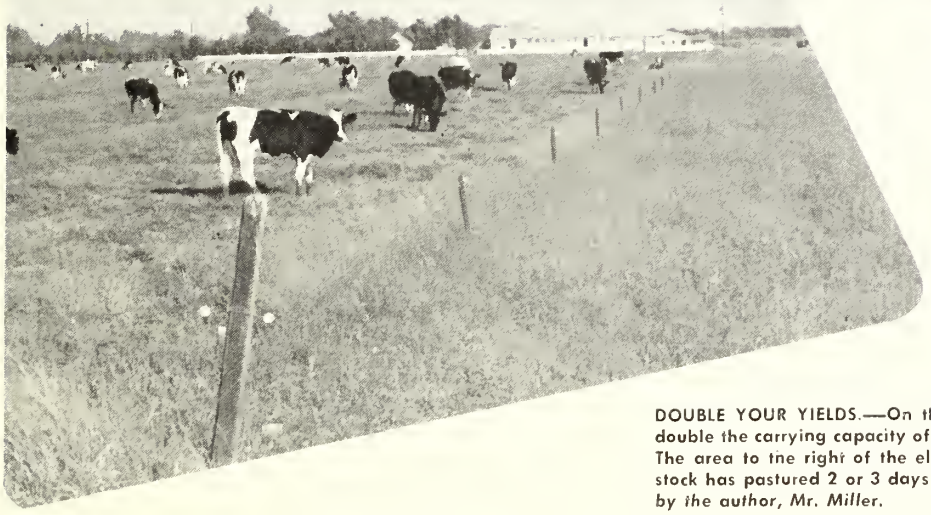
The ABC's of Irrigated Pastures

by MILTON D. MILLER
Farm Advisor,
University of California,
Glenn County, Calif.



DOUBLE YOUR YIELDS.—On the Orland project, Wackerman Bros. double the carrying capacity of their pastures by rotational grazing. The area to the right of the electric fence will be grazed after the stock has pastured 2 or 3 days in the field at left. ***Photo submitted by the author, Mr. Miller.***

THERE IS PROFIT IN IRRIGATED PASTURES.

Farmer after farmer in California is turning off 400 to 600 pounds of livestock gain per acre each year from irrigated legume-grass pasture land in which he has an investment of from $300 to $400. When beef and lamb on the hoof were selling for $25 to $30 per hundredweight, these irrigated pasture owners were netting from $65 to $125 per acre per year above their annual pasture production costs of about $35 per acre.

The volume of land planted to irrigated pasture in the State has doubled in the last 4 years and is now placed at over 600,000 acres. But it has taken over 25 years of experience to build up a requisite backlog of management know-how. Here are some of the newer ABC's of profitable pasture management which have developed from this experience.

GRAZING MANAGEMENT IS IMPORTANT. The advantages of rotational grazing are strikingly illustrated by the results secured by the Blaettler Bros. on their dairy in Santa Clara County. In 1948 they cross-fenced their 52-acre pasture into three subdivisions. Their 92 cows rotated from one subdivision to the other, grazing each section 10 days. That first year, feed replacement value of the irrigated pasture was found to be equal to 2.5 tons of alfalfa hay per acre. Although apparently practicing rotational grazing, their results were not up to expectations. They were not letting their pastures recover sufficiently between grazings. Under this 10-day grazing system, milk production began dropping about the third or fourth day, with an average loss of three cans of milk per day for the last 6 days in the grazing period.

In 1949, at the suggestion of the farm advisor, the 52 acres were divided into 30 paddocks. The herd, which had increased to 110 cows, grazed one paddock a day. Under this rotating schedule, any one paddock was rested 29 days between grazing. Feed replacement in 1949 was twice that of the previous year—5.5 tons of alfalfa hay per acre. Moreover, milk production was maintained at a continuously high level.

Dr. M. L. Peterson at the University of California Experiment Station, Davis, Calif., has been testing grazing methods. His trials prove that pasture forage yields can be increased by more than 60 percent by lengthening the period between grazings from 2 to 4 weeks. According to his tests, cattle do best if 3 to 4 weeks elapse between grazings of ladino clover-grass mixture. Four weeks' regrowth are necessary where alfalfa is the principal legume in the mixture.

Pasture fertilization pays off. On the Orland project of the Bureau of Reclamation, farmers are doubling and trebling forage yields by using nitrogen and phosphorous fertilizer applications. A late winter or early spring application of 500 pounds per acre of single superphosphate is now common. This is frequently followed by a March application of 200 pounds of ammonium sulphate and a similar application in August. Nitrogen fertilizer applications invariably step up grass production in all Glenn County irrigated pastures.

University of California tests on the Orland project show that the phosphorous content of pasture plants may be improved by applying phosphorous fertilizers to pastures. This opens up the possibility of improving the feeding value of pasture plants by fertilization.

Many dairymen have doubled pasture yields simply by saving and returning manure and barn washings to their irrigated pastures. Conserved in liquid manure pits, this source of increased fertility is pumped back onto the pastures through the irrigation system.

Water loving weeds seriously reduce pasture yields. Glenn County irrigated pasture owners mow their pastures at least twice each year; once in the spring and again in late summer. Many pasture owners mow a portion of each paddock ahead of each grazing period.

Each year, they also spray 2,4-D on about 20,000 acres of Glenn County ladino clover-grass pastures. This kills off dock, buckhorn, chicory, ragweed, yellow star thistle, and other weeds which reduce forage.

However, 2,4-D is fatal to trefoil and alfalfa, and must not be used on pastures where they are the principal legumes. Even on ladino clover, the spray must be properly timed, and the field kept well irrigated for 60 days following the application. Under Orland project conditions, the farmers spray in April. They apply 12 ounces of the acid equivalent of 2,4-D as an amine salt in 30 gallons of water to an acre, using a ground rig. This method, providing excellent control of most of the troublesome broadleaved pasture weeds in ladino-grass pastures, is popular and highly recommended for pasture weed control.

Irrigated pastures, a crop in the rotation system. Glenn County farmers are convinced crop rotation on irrigated pasture land helps to control weeds, improves the physical condition of the soil and permits the pasture operator to judiciously cash in on the build-up in soil fertility resulting from the pasture program.

Take the case of Farmcrest, the Wackerman Brothers' farm on the Orland project. Farmcrest is divided up into many 5-acre fields for rotational grazing. Every year a sixth of their oldest pasture land is plowed up in October and planted immediately to oats, or oats and vetch, for hay or silage. Early in June, the following year, they harvest about 3 tons of hay (or its equivalent) as silage. They then immediately plant another crop for silage—hybrid corn. The corn silage, at the rate of about 20 tons per acre, is harvested in late September or early October. The field is then promptly reseeded to irrigated pasture and left in for another 5 years. Coupled with other sound management practices, this system of crop rotation has doubled the stock-carrying capacity of their 60-acre ranch since they have owned it.

Managing meat animals on pasture. Irrigated pasture owners have known for some years that it pays to have dry roughage available for cattle and sheep on ladino clover pasture. For one important reason, it helps to control bloat. A mature animal, on an average, will eat about 1 ton of barley straw or similar low-grade roughage per head each season, in addition to the pasture.

Beef cattlemen of Salinas have been cooperating with the University of California Extension Service on a series of trials. In one large-scale field trial, gains from pasture, and supplements of 3 pounds of rolled barley and 4 pounds of grain hay per head per day, produced 640 pounds of gain per acre of pasture fed during the year. In another trial with an owner of beef cows and calves, 869 pounds of gain per acre of pasture per season were recorded when the pasturing stock was supplemented with barley and barley hay.

The newest development in pasture feeding is to use salt to regulate the intake of self-fed supplemental feed. Here is one mix which has given good results when self-fed to beef cattle on irrigated pastures:

200 lbs. salt
600 lbs. rolled barley
600 lbs. beet pulp
600 lbs. cotton seed meal

Although not widespread, the finishing of beef cattle on irrigated pasture is on the increase in California. ###

A Well-kept Lateral Gathers No Moss

Part 1—How To Use Aromatic Solvents To Control Water Weeds in Irrigation Laterals

by JESSE M. HODGSON, Assistant Agronomist, Division of Weed Investigations, University of Idaho

EDITOR'S NOTE—The following article was prepared on the basis of the cooperative investigations of the Division of Weed Investigations, Bureau of Plant Industry, Soils and Agricultural Engineering, Department of Agriculture, and University of Idaho, and was adapted from information contained in Idaho Extension Circular No. 123.

A ROLLING STONE MAY GATHER NO MOSS—but often a swiftly flowing irrigation ditch may become clogged with moss-like weeds.

Farmers who handle irrigation water to nurture their crops, as well as managers and operators who handle water for entire distribution systems, have long been plagued with this problem.

These submersed waterweeds increase their nuisance value by making their greatest growth when they can do the most damage. When field crops need the most moisture, that is when under-water weeds slow the flow of water. That is when they often choke up the water-handling facilities and cause serious crop losses by interfering with water deliveries. When farm machinery and workers are badly needed on other parts of the irrigated farm—that is when waterweeds are flourishing, and the irrigation farmer or manager has to stop farm work long enough to clean the water-delivery system.

New developments have gone far in solving this old problem for the irrigation farmer. Aromatic solvents taken from petroleum and coal tar and applied in the irrigation water kill the weeds in a short time and restore normal water flow. (The development of aromatic solvents by the Bureau of Plant Industry and Bureau of Reclamation was reported on page 81 of the May 1948 issue of the RECLAMATION ERA in the article entitled, "A New Killer for Water Weeds.") Dead weeds are no problem. They slowly disintegrate, and the water in the laterals gradually carries them away.

Tests in Idaho and other Western States show that the aromatic solvents are effective on sago

MOSSY MENACE, held by Author Hodgson at lower left. Below, waterweeds get a dose of weed control chemical in the Black Canyon Irrigation District lateral on the Boise project in Idaho. ***Both photos by Stan Rasmussen, Region 1.***

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pondweed, leafy pondweed, and horned pondweed. In Idaho they call these weeds "horsetail moss." No matter what they are called, they have been nuisances in irrigation systems. But nowadays they all give way to aromatic solvents.

Treating waterweeds is not a complicated process. Any good sprayer with nozzles having 0.02 to 0.04 inch orifices will do the job. Common weed sprayers, livestock sprayers, or orchard sprayers are fine. Oil-resistant hoses should be used. Pressures of 40 pounds or more are satisfactory. Higher pressures of 100 to 150 pounds are better.

Place the nozzles of the sprayer under the surface of the water at the point in the ditch or lateral where treatment is to be started. Just above a weir is a good place. If you hold the nozzle under the water, the solvent and emulsifier will mix with the water. This forms an emulsion that contacts the weeds as the water flows down the channel. Putting the solvent into the water at the weir where the water is naturally agitated helps mix the emulsion into the entire stream. If you use high pressures in the sprayer and finer nozzle orifices, they will break the solvent into finer particles. Then you will be sure the chemicals are properly mixed with the flowing water and will contact the weeds.

How much of the aromatic solvent is required to kill the weeds in a particular ditch or lateral depends on the amount of water flowing and the distance to be treated. (See article entitled, "Short Cuts to Weed Killing Operations, Part 8—How to Apply Aromatic Solvents to Control Waterweeds" on page 18 of the January 1952 issue of the Reclamation Era and the article entitled, "Slide Rule for Waterweed Control" by Mr. Hodgson, in the April 1950 issue.) For a ditch ¾ to 1¼ miles long, use 6 gallons of aromatic solvent for each cubic foot per second of flow. Tests show that this quantity will control the waterweeds for a ditch of this length. Put this amount of solvent into the water in a period of 20 to 30 minutes. Do not forget that 6 gallons are required for every cubic foot per second of water flowing. Thus, for a ditch carrying 6 cubic feet per second of water, 36 gallons of solvent would be needed. A flow of 10 cubic feet per second would require 60 gallons. But in all cases, the time for treatment remains the same. The solvent must go into the water for 20 to 30 minutes.

For a ditch 1¼ to 3 miles long, use 10 gallons of aromatic solvent for each cubic foot per second. According to tests, treatments at this rate sometimes extend much farther than 3 miles. Conditions of the water and weeds of each ditch will determine the exact distance that weeds will be controlled, and the point where a second (or "booster") application should be made.

Before making the treatment, check your sprayer to see that it will deliver the desired amount of chemical. Nozzle manufacturers usually supply tabulated information regarding their product. If these tables are not available, you can determine a nozzle's delivery by catching the spray in a measure for 1 minute. The measured amount multiplied by the number of minutes for a treatment gives the delivery of that nozzle for the treatment period. For the check run, set your sprayer at the desired pressure and make the check with the chemical mixture you will use in the actual treatments. (For an easy-does-it method, see the article entitled, "Short Cuts to Weed-Killing Calculations—Part 9—Calibrating the Rig for Aromatic Solvent Applications," on page 32 of the February 1952 Reclamation Era.)

Reducing the water flow before treating is often possible and advisable, but it is always essential to maintain enough water in the ditch so that the weeds are well supported and so that the emulsion will be well dispersed around them.

Knowing the amount of water flowing in the ditch *at the time of treatment* is positively essential if the control is to be successful. Too little solvent in the treatment not only results in poor weed-kill but wastes the material as well as the time and labor of the operator.

Next Month

MORE FACTS ON CONTROLLING WATERWEEDS

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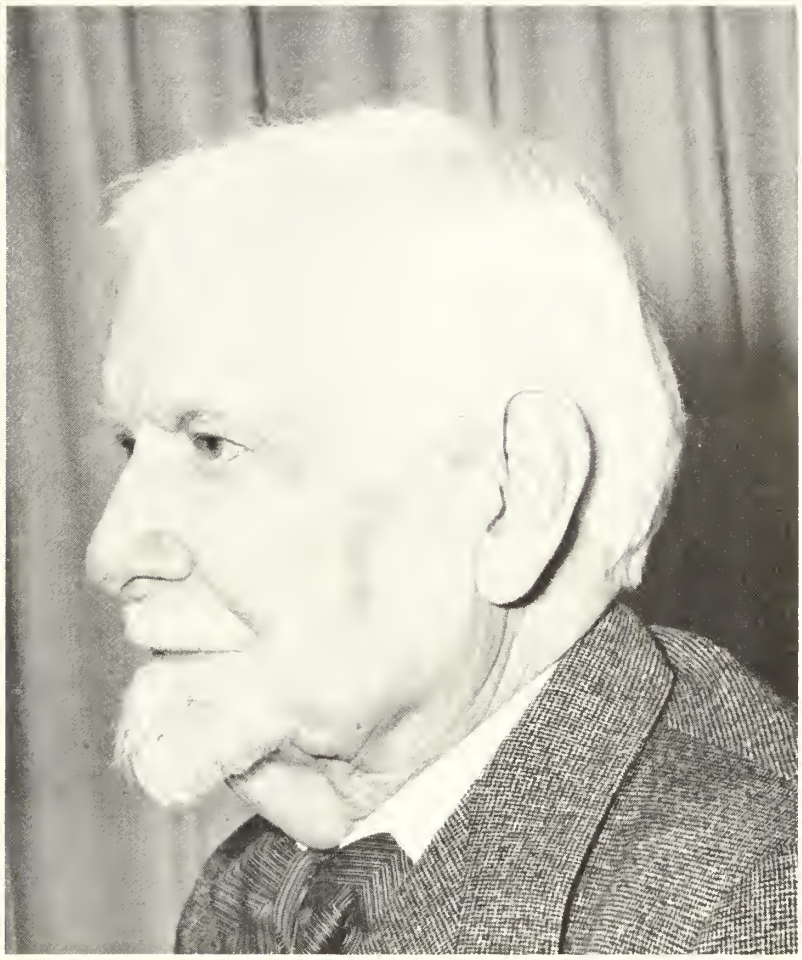

RECLAMATION'S HALL OF FAME

Nomination No. 16

WILLIAM R. WALLACE

Dean of Utah Reclamationists

William R. Wallace, considered for many years the dean of Utah reclamationists, constantly reminds himself of Plato's admonition, "The proud man is forsaken of God." He does take pride, however, in his 20-year record (1923–43) as chairman of the Utah Water Storage Commission. Half of the members of the commission were Republicans; half were Democrats. All water problems were worked out on a strictly nonpartisan basis, and every decision was by unanimous vote.

Of two other things is he proud. In 1948 the University of Utah bestowed upon him the honorary doctorate of jurisprudence, and in 1952 the Utah State Agricultural College at Logan, Utah, accorded him the honorary degree of doctor of engineering.

He has every right to be proud of his record for more than 40 years as an active proponent of water resource development and reclamation.

In 1910, former Utah Gov. William Spry asked Mr. Wallace (fondly called "Billy" by his associates) to do something to help develop Utah's water resources. He is known chiefly for that avocation, although he has other claims to fame. He was one of three Utahans who developed the first company to refine high octane aviation gasoline. The other founders of the Utah Oil Re-

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A DYNAMO AND DYNAMITE.—William R. Wallace pushes the plunger that touches off the first round of shots in opening the west portal of the Gateway Tunnel, formally starting construction on Utah's largest reclamation development, the $70,000,000 Weber Basin project on January 9, 1953. In the photo besides Mr. Wallace are (l. to r.) T. A. Clark, construction engineer, Bureau of Reclamation; Colonel H. H. Needham, commanding officer, Ogden Arsenal; three officials of the Weber Basin Water Conservancy District: LeRoy B. Smith, director; Harold G. Clark, director; and W. R. White, president, and George R. Putnam, vice president and district manager, Utah Construction Co., contractor for the tunnel job.

fining Co. in 1916 were John C. Howard and John F. Bennett.

Billy Wallace gave more than lip service and long hours of work to the cause of reclamation. He put up his own money to finance the initial investigations during the 1921–23 biennium which led to the permanent establishment of the Utah Water Users' Association in 1923, of which he was president for 5 years. According to T. W. Jensen, secretary of the Utah Water Users' Association, the 1923 Utah State Legislature appropriated $30,000 to reimburse Mr. Wallace for the expenditure.

As chairman of the Utah Water Storage Commission, Mr. Wallace was one of the most active backers of the Provo River project. He is personally credited with keeping the Federal program of investigations on the Deer Creek (Provo River) and other projects alive between 1929 and 1933. During this 4-year period, no Bureau of Reclamation funds were allocated for investigations in Utah. Billy Wallace offered his personal guaranty for the funds. With this evidence of good faith, the storage commission succeeded in obtaining State appropriations to cover the entire amounts necessary to continue the program.

Another valuable service was performed by Billy Wallace in 1937 and 1938 as a member of the three-man Repayment Commission. He and George T. Cochran, with Charles A. Lory as chairman, were appointed to "investigate repayment problems on Federal and Indian reclamation projects." Their findings influenced legislation incorporated in the 1939 Reclamation Act, including the so-called variable repayment plan.

Mr. Wallace was the leading exponent of legislation creating the Utah Water and Power Board, known as "Utah's Little Bureau of Reclamation for construction of small projects." He has been chairman of this organization since its inception in 1947. He has also been chairman of the Colorado River Commission, of the Utah State Planning Board, a director of the National Reclamation Association, and a member of the Utah State Drouth Relief Committee.

Although 87 years of age, he plans to visit Alaska's Eklutna project at his earliest convenience. He has already personally visited every Federal reclamation project in the 17 Western States. An inveterate traveler, he has managed to sandwich trips abroad in with his reclamation activities. He has sailed to the British Isles and

South Africa, and made several plane trips from London to points on the Continent—Lisbon, Madrid, Rome, Milan, Vienna, Zurich, and Munich.

Knowing that in many parts of Europe farmers are still harvesting with a sickle and treading the grain out on a threshing floor, Mr. Wallace observes: "In this country, with 60 million employed, we are producing wealth at the rate of $4,000 per person annually. This should permit our young people to face the future without fear."

William R. Wallace was born December 10, 1865, in what is now the heart of Salt Lake City's business district.

His parents, Henry and Ellen Hetherington Harper Wallace, had come to Utah from England 3 years before.

Mr. Wallace married Annie McCrystal in 1892, in Salt Lake City. She bore five children, a daughter who died in childhood, and four sons now prominent in business and professions, John M., president of the Walker Bank & Trust Co.; Henry A., manager of Utah Oil Refining Co.; Alexander C., Salt Lake City engineer and financier; and William R. Jr., San Francisco, attorney. Mrs. Wallace died in 1939. There are four grandchildren.

This is his own biography: "I was born on the corner now occupied by the Moxum Hotel and, as a boy, carried water to the elephants to get into the circus. After that I grew up." His career has proved that this early experience did not create in him a permanent dislike for water.

In 1934, he was chosen "Salt Lake City's First Citizen of the year 1933." At the Salt Lake Advertising Club's Award Banquet on March 14, 1934, the former Governor Henry Blood paid him the tribute which appears at upper right. Billy Wallace concluded his response to the Governor's tribute by describing a dream he had:

"I flew up and down the length of our great State, and in every town and village in this arid land, the contented citizens were planting their crops in peace and comfort. Harvest was assured, for back among the hills there had been impounded a plentiful water supply. That is my task. That is your task. We are accomplishing much and I have come to hope—almost to believe—that it will be my great privilege to see my dream come true."

Mr. Wallace has worked unceasingly to carry out Governor Spry's assignment and still looks forward, at the ripe age of 87, to future years of

Salt Lake City's First Citizen

The following tribute was paid to William R. Wallace by former Governor of Utah Henry Blood on March 14, 1934:

The vision of this man has served and is protecting the people of our State. He saw the danger of aridity advancing to thwart the purposes of the pioneers of the State. Perhaps no man has studied more keenly and continuously the needs of the State of Utah and her people, nor has any felt more deeply and sympathetically the trials incident to conquering the semiarid region that is Utah and making it literally blossom as the rose.

A little while ago I learned for the first time that never in all his civic career had William R. Wallace received the slightest remuneration. I could not buy his ticket; I could not pay his hotel expenses. He was there in Washington as a citizen of Utah bearing his own expenses and assisting mightily in our work. I want to acknowledge here and now that the work of Mr. Wallace in connection with the securing of something like $14,000,000 of reclamation money was the turning point in our joint efforts of the moment, and the efforts of the Congressional Delegation.

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effort in the same cause. He views with great satisfaction the strides that are being made toward comprehensive development of the Upper Colorado River Basin. His hope for the future is that the Lower and Upper Basin States will be able to agree upon a plan of development from the river system's source to the ocean—a plan that will put every drop of water to beneficial use. ###

Canyon Ferry Nearing Completion

With the award of the final major contract to complete construction of the Canyon Ferry Dam, Power Plant and Switchyard, on the main stem of the Missouri River, 17 miles from Helena, Mont., this key control structure for irrigation, flood control and hydro-power generation in the Canyon Ferry Unit, Helena-Great Falls Division of the Missouri River Basin project, should start producing power by the end of this year.

Eiseman, Seabrook, and Elliott, of Chula Vista, Calif., won the contract for the final stages of construction in the power plant on a low bid of $694,183.50, and started work in February. According to the contract, the first of the three 16,666 kilovolt-ampere generators is to go on the line by December 1953. The second is scheduled for production in 360 days, or late February 1954, and the third in 420 days—April 1954.

Canyon Ferry Dam will be 220 feet high, with reservoir storage space for 2,050,000 acre-feet of Missouri River waterflow and powerplant of 50,000 kilowatt generating capacity. #

Don't Gamble with water quality

by BRUCE F. BEACHER, Soil Scientist, Bureau of Reclamation, Washington, D. C.

MANY OF US REALIZE that our standards for water quality, like many other standards, are averages based upon experience or demand. Just as soils, crops, farm management and irrigation practices can be varied from place to place, so may the type of water which is good or bad vary from one locality or another. Underlying these things are the economic and social conditions which largely determine what we can or cannot do and the standards for success of any venture.

You might travel through Egypt or the Middle East and find date palms, garden vegetables and alfalfa being successfully irrigated with low quality water. The Egyptian, Iraqi, or Saudi-Arabian is faced with survival, and a successful crop is one which furnishes food and fiber for today's family needs alone.

The water user in this country is part of a quite different, highly competitive, economic and social system which demands his best efforts and the best use of resources available to him.

But water users everywhere have one problem in common—to maintain, if not improve, the productivity of the land from which our food and fiber must continue to come. With this in mind, what can be done if the experts say that your water supply is questionable or unsuitable for irrigation?

First, heed the warning and avoid using such water if at all possible. Remember that the water in the soil becomes as much as 10 to 100 times more salty than the irrigation water. You are gambling against odds that may be two to one or one hundred to one, depending upon your soil, type of crop and your irrigation skill.

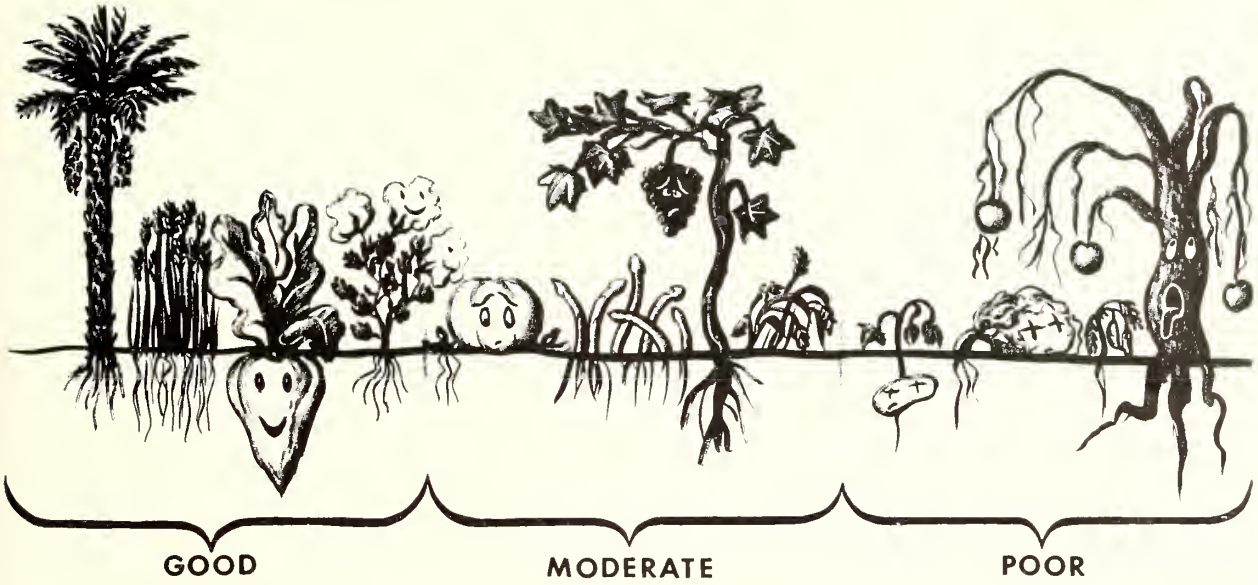
If you must gamble, there are ways to reduce the odds. The most important thing is drainage. Sometimes low quality water can be used for a long time, if you have good surface and subsurface drainage to prevent building up the salt content of the soil. Some soils drain readily as the land has sufficient slope and natural outlet channels to allow the leaching waters to move off. Other lands need grading and leveling, tile drains, open drains, or pumping to keep percolating waters with their salt burden moving down and out of the root zone. If your land does not drain freely, find out if you must install drains. If you cannot afford the drains, then your standards for water quality and water use must be set very high, or your son, grandson, or great grandsons may inherit a salt flat.

The vast wastes of land in Iraq, once irrigated from the Tigris and Euphrates Rivers, which contained only a little salt, are mute evidence of poor drainage. And in this country thousands of idle acres of alkali land in Colorado's San Luis Valley and other places show what can happen in a relatively short time. Reclaiming such land is usually a very expensive, long-term job.

For a simple but effective rule, do not use water of questionable quality on land that can't be drained.

The Bureau of Reclamation has a special interest in drainage and strives to foresee and control such problems by land classification, drainage investigations, water studies and timely construction of outlet drains for you. But this is only part of the job. Proper use of water and installation of tile drains on the farms are often the key to effective drainage. It is up to the water user to see the job carried through successfully.

The manner in which water is used has much to do with the quality required for sustained irrigation. More water of low quality must be used so that salt from previous irrigations will be leached and adequate moisture will be present in the soil for the crops. The more salty the water, the more difficulty most plants have in absorbing it through their roots. As the soil becomes drier, the soil water becomes saltier. If the water is quite salty to begin with—and remember that most drain waters and ground waters are—the plants may wilt before the soil is dry. Seedlings are especially sensitive and it is important to supply enough water for their needs by more frequent irrigation. At the same time, avoid wasteful use of water causing seepage and erosion.



Salt Tolerance

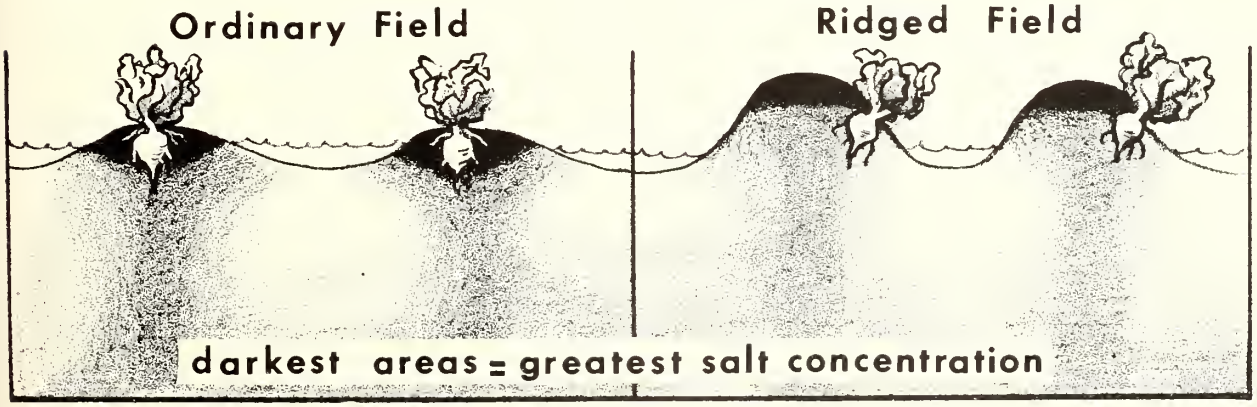
REDUCE THE ODDS by planting the right crop for your soil and water quality.—Date palms, some grasses, garden and sugar beets, and cotton have good salt tolerance. Cantaloupes and tomatoes, sometimes asparagus, small fruits like figs, grapes and olives, alfalfa, some grasses, clovers and many truck crops, are moderately tolerant to salt conditions. White and sweet potatoes, artichokes, beans, citrus and tree fruits, some grasses, clovers and truck crops, are extremely sensitive to salt. Further information may be obtained from the United States Salinity Laboratory, Riverside, Calif. Drowing by Graphics Section, Washington, D. C.

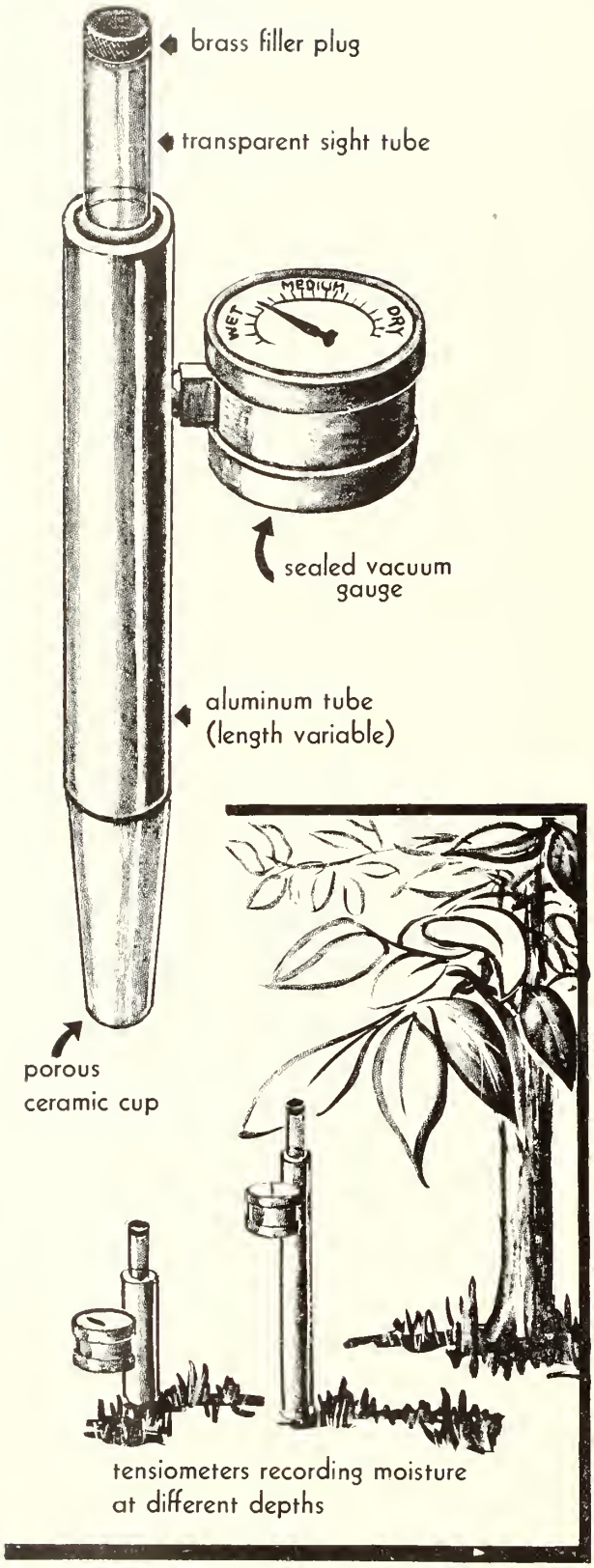
You can find good use for the new low-cost moisture meters or tensiometers which take some of the guesswork out of irrigating and may save your crop without wasteful use of water. In areas where rainfall and snowmelt are not enough to leach salts during off-season periods between crops and especially before planting, flooding and leaching are necessary.

Certain crops and varieties and strains of crops are known to be relatively more salt tolerant than others. The date palm, sugar beet, garden beet, milo, rape, kale, cotton, Bermuda grass, wild rye, wheat grass and several other grasses have proved to be quite tolerant. On the other hand, many fruit trees, clovers, potatoes, celery, green beans, egg plant and other truck crops are sensitive to salty water and saline soils. Although some plants become more resistant to salinity as they mature or develop resistance over longer periods of time, such as in the case of alfalfa, a wise choice of tolerant crops will prove best.

Another way of meeting the problem of salty water is ridging the soil for the seedbed. Salt accumulates on the side of the ridge above the level

HOW TO BY-PASS SALT BY RIDGING.—*Drowings by Grophic Section, Woshington, D. C., bosed upon informotion published by the University of Arizono ot Tucson, ond the United Stotes Solinity Loborotory, Riverside, Colif.*





of water in the furrows. The seed can be planted below this level and the plants will root down into soil which is less saline. A practice with beets is to throw up ridges over the seed to protect against rapid drying of the soil. Eradication of grasses and weeds which compete with crops for moisture is important. Mulching will also aid in control against rapid drying of the soil.

Finally the water itself may be diluted with better water or chemically treated. In many places the drain waters, ground waters, and return flow must be diluted ten times or more for safety in use. Reservoir releases should be made when the stream flow becomes too low for effective dilution of return flow. Chemical treatment of water which contains a high percentage of sodium—the element linked with black alkali and poor drainage—is possible if the water has a low total salt content.

The ratio of calcium and magnesium to sodium is important, and a few hundred pounds of gypsum or calcium sulfate added to an acre-foot of water may create a satisfactory ratio. But in many cases, a full ton of gypsum is necessary. The California Extension Service has devised a simple machine to add powdered gypsum to irrigation water by using a belt running under a hopper filled with gypsum. Newer methods of treating water are being studied. The Bureau of Reclamation is leading a search for practical electrochemical processes and other methods to improve present water supplies and to convert sea water to useful irrigation supplies. But the search will take time and difficult technical problems must be solved to develop low-cost, large-scale methods.

Meanwhile, know the quality of the water you must use and use it properly to conserve and perpetuate the productivity of the land for tomorrow's generations. Don't guess—have your water tested. If the report on your water is not good, perhaps there is some way to use it safely. Your county agent, State experiment station, extension service and Federal agencies are willing to assist you. But remember that the use of any questionable water for irrigation is a gamble with one of our most valuable heritages—and the odds may be one hundred to one against you. ###

HOW TO TAKE THE GUESSWORK OUT OF IRRIGATION by using a moisture meter to tell you when and how much to water.—*Drawing by Graphics Section, Washington, D. C., based upon material from the Irrigation Engineering Co., Riverside, Calif.*

An irrigated cotton field about 10 miles north of El Paso, Tex., on the Rio Grande project.
Photo by Dale A. Hovey, former Region 5 photographer.

THE MIRACLE OF THE RIO GRANDE

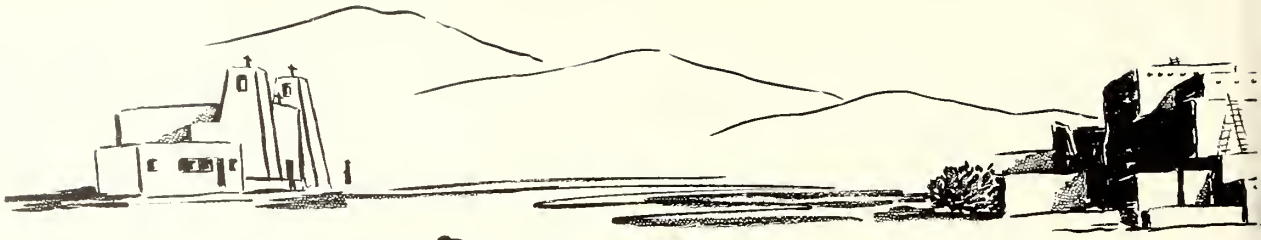
by WILLIS C. BOEGLI, Agricultural Economist
Operation and Maintenance Division
Amarillo, Tex., Region 5

FROM THE CULTIVATION OF NATIVE CORN with the stone hoe to provide food for a few Indian families to a modern miracle of irrigated crop production valued at over $45,000,000 a year, is the agricultural history of the Rio Grande irrigation project in southern New Mexico and southwestern Texas.

The total cost of the irrigation facilities was about $10,700,000. It is estimated that another $10,000,000 has been spent in the development of the project lands, and a similar amount in river rectification and channelization work, making a total cost of approximately $30,500,000 which could be directly or indirectly attributed to irrigation. This capital investment has created a crop value of over $533,000,000 in the past 38 years.

When the Spanish explorer Cabeza de Vaca and his colorful band of mounted adventurers wandered up the river in 1536, they found Indians cultivating corn along the Rio Grande near the present site of the city of El Paso. Other explorers followed, and in 1598 Padre Garcia de San Francisco Y Zuniga established a Mission across the Rio Grande and began schooling the Indians in more advanced methods of growing crops.

During the years of the exploration and Mexican colonization of the Rio Grande Valley to and beyond Santa Fe, the pueblos near El Paso



flourished as a stopping place for the travelers as they moved from the eastern shores of old Mexico north into this new land. In 1682 an Indian brave of the Tehua tribe named Pope led a revolt which drove the white invaders and the Christianized Indians from New Mexico into the El Paso area. The serious need for food resulted in the establishment of several pueblos south of El Paso where the waters of the Rio Grande were used to irrigate the lands.

In 1805, the Mexican Government gave Don Juan Garcia a land grant near the present site of Las Cruces, N. Mex., which was the original settlement from which the agriculture of the New Mexico portion of the project developed. With the western movement of the American pioneers during the period 1840–60, the irrigation development grew rapidly and it is estimated that 40,000 acres were irrigated by various diversions from the Rio Grande.

Irrigation from the Rio Grande above this area, both in New Mexico and Colorado, reduced the summer flow of the river, causing severe shortages of water for irrigation not only on the American side of the river but also for the Mexico developments south of the Rio Grande. As a result of a petition of the Mexican Government, a treaty was concluded in 1906 with the United States dividing the waters of the Rio Grande between the two nations and providing for a storage reservoir which would prevent the severe water shortages.

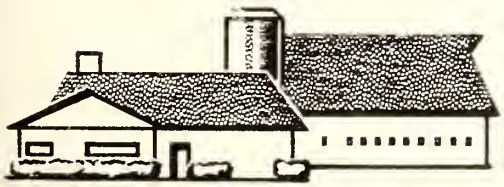
In 1906, before New Mexico was a State, the Reclamation Service filed intentions to appropriate waters from the Rio Grande for the proposed reservoir. Construction of the Elephant Butte Dam began in 1911 and the first water was stored in 1915. Since that time a hydroelectric plant has been installed at the dam and many changes have been made in the irrigation distribution system, including new diversions from the river and construction of a drainage system.

The human struggle from the days of the Indian with his stone hoe to the present time has created

FROM PRIMITIVE BEGINNINGS, irrigation in the Rio Grande Valley has become a multi-million-dollar asset to the Nation. Above, a typical scene of modern farming methods—alfalfa baling operations on H. E. Elmendorf's property, 4 miles south of Las Cruces, N. Mex. At right, an artist's conception of the continuous freight train which would be required for crops produced on the Rio Grande project from 1914 through 1951. The irrigated crops have made possible the development of a growing community in the project area. *Photo by A. E. McCloud, former Region 5 photographer. Drawings by the Graphics Section, Washington, D. C.*

a modern miracle of food and fiber production. During the period 1914–51 inclusive, the project has produced over 3,000,000 bales of cotton, over 1,000,000 tons of cotton seed, and 4,500,000 tons of alfalfa hay, in addition to thousands of tons of vegetables, grains and other crops. Converting this production into carloads and the cars to trains, this production would require a continuous freight train from El Paso, Tex., to New York City; El Paso to San Francisco, and El Paso to Chicago. In 1951 alone the project produced the equivalent of 2,879 cars of cotton lint; 3,131 cars of cotton seed, and 2,131 cars of alfalfa hay, or about 81 trainloads of crops produced.

The value of crops produced during the period 1914 to 1951 inclusive, was over $533,000,000 while the value of crops produced in 1951 was $45,842,000. In addition to the vast quantity of food and fiber that are ultimately manufactured from the project production, it has made homes for 5,331 farm families, suburban homesites for an additional 3,482 families. Ninety schools and



5,331
FARM HOMES

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90
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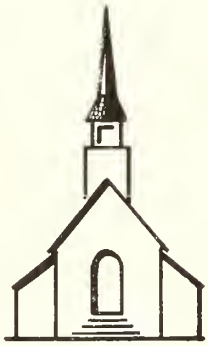


190
CHURCHES

190 churches are scattered over the project area attesting to the social and religious development of the people.

Irrigation has been the magic that changed the Rio Grande desert with a few Indian farmers to one of the greatest food and fiber producing areas of the Nation. Man's ingenuity, determination and skill has achieved much since the days of the Indian with the stone hoe. ###

University of Colorado Aids World Water Resource Development With Special Reclamation Study Course

Successful American business methods and management techniques are for the first time being made available to aid water resources development in foreign lands under a special course of instruction at Denver, Colo., jointly sponsored by the University of Colorado School of Political Science and the Bureau of Reclamation.

Student engineers from Thailand, India, Australia, Mexico, Brazil, Formosa, Turkey, Nepal, Colombia, Israel, and Chile were included in the first class of 25 which began a 16-week study of American management techniques in January at the Reclamation Engineering Center under the guidance of Dr. Leo C. Reithmayer, chairman of the graduate curriculum in Public Administration of the University of Colorado.

The new course of instruction was installed primarily to meet the continuous requests of foreign governments for "know how" in meeting management prolems encountered in the administration of their own water resources development programs.

None of the expenditures are met from the Bureau's domestic water resource development program. Expenses are met by funds furnished under the Point IV program of the Department of State, the Mutual Security Agency, or by the foreign governments themselves. #

HAVE YOU CHANGED YOUR ADDRESS LATELY? GOING TO MOVE SOON?

Let us know immediately so we can change our mailing list—it takes time, you know.

We'll do our best to deliver the RECLAMATION ERA to your correct address, but we have to know what it is.

Cachuma Dam Now Controlling Santa Ynez River

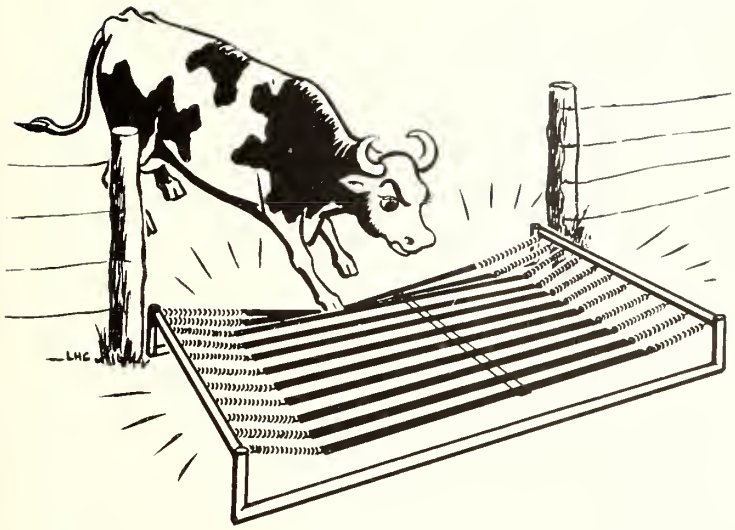
Last month the widely fluctuating and erratic flows of the Santa Ynez River in Santa Barbara County, Calif., were brought under control by the virtually completed Cachuma Dam. Winter runoff was being stored in the reservoir, and the outlet valves in the dam, through which water can be released downstream, were installed.

By the first of February, water in Cachuma Reservoir was more than 30 feet deep at the dam, or several feet above the dead storage level. Regional Director Richard L. Boke announced that Bureau forces would continue to store water, subject to the 1949 contract with the Santa Ynez River Water Conservation District and commitments to the Army for Camp Cooke. Deliveries could not be made through the 6-mile Tecolote tunnel, as the contractor had more than 6,000 feet to go. Completion of the tunnel is more than a year away.

Santa Barbara is the town where water was so scarce people could not sprinkle their lawns or wash their cars. When exceptionally heavy inflows of water were encountered in the outlet leg of the tunnel in August 1951, measures were immediately taken to tap this unexpected source of water. The flows, which carried loose material into the tunnel, were under control by November 1952. While awaiting completion of Tecolote tunnel, the people of the City of Santa Barbara and vicinity are getting the benefit of water seeping into the tunnel.

Mittry Constructors of Los Angeles, contractors for Cachuma Dam, expect to complete their contract by April of this year. Construction work is moving along on the other features of the $36,000,000 project which will provide domestic and irrigation water for Santa Barbara and its coastal plain.

The Goleta section is almost completed, with the South Coast Conduit, completed in July 1951, now in partial use. The Lauro Regulating Reservoir was completed in October 1952. Work on the Lauro Control Station, delayed by scarcity of materials, did not get under way until December 1952 but should be completed early this year. The only work remaining to be done on the Glen Anne Regulating Reservoir is protection of the upstream and downstream faces of the embankment. Work on the first unit of the Goleta distribution system should be under way by next month. #



"BEDSPRING" CATTLEGUARD

by
THEODORE NELSON, Chief
Irrigation Operations Branch
Region 1, Headquarters, Boise, Idaho

WALTER WHITE MANAGES THE VALE, OREGON AND WARM SPRINGS Irrigation Districts in Malheur County, Oreg., and puts in long hours on the job. But when irrigation farmers drove by his small pasture a year ago, they wondered whether it was really necessary for him to move his bed onto the ditchbank.

Actually, they were seeing a new type cattleguard. Walt had placed it in the fence line where his driveway left the oil-topped highway, and followed a small lateral to his home. The guard looks like a bedspring, but is narrower and has no undercoils. It is Manager White's idea of an economical and effective cattleguard that water users can build in their own shops during the slack winter months.

Such a device is a time, money, and water saver. Ditchriders will not have to stop and open gates when they are trying to outrun a canal break. They can save the time spent in stopping, opening, and closing a gate every day of the week at every fence line when they have a definite water delivery schedule to meet, weeds to pull, or cattails to cut

SHINY AND SPRINGY enough to discourage cattle; strong enough to permit vehicles to cross. *Photo by Dan Applegate, Region 1.*

out of Bill Jones' weir pool. White knew all this. He has spent much of his time on ditchbanks inspecting structures, outlining work programs, and meeting water users in the field, giving them a first-hand solution or advice on their irrigation problems.

As a good manager, he realized that the water users paid the bill for delays caused by opening and closing gates, and that something ought to be done about it. Yet, could they afford a pit concrete and steel cattleguard, costing from $250 to $400 at each fence? What they needed was a cattleguard that could be constructed at a reasonable cost. White felt sure that the farmers would cooperate and install their own cattleguards if costs were low, particularly if they could be built at home without too much difficulty.

With this in mind he made a frame of 1¼-inches pipe, 50 inches wide by 120 inches long. Initially the side members of the frame were 11½ inches long, but 9 inches on each end were turned up at right angles. A 48-inch piece of the same sized pipe was welded between the tops of the upturned ends. To the crosspieces on each end were welded eleven small rings evenly spaced, and into each ring was hooked a spring one inch in diameter, and 12 inches long. From each spring was suspended a strip of 1½ by ¼-inch strap iron with sufficient tension to carry the strap iron approximately 6 inches above ground in a floating position. To hold the eleven strips in a uniform position and to reduce rebound when a vehicle passed over the guard, a crosspiece of strap iron was welded midway from the ends, creating a floating grill in suspension from this light pipe frame.

After a season's trial in the entrance to his own pasture, White felt this floating grill cattleguard performed very well. There was no evidence of cattle ever having attempted to step into or jump across it. No doubt the bright coat of aluminum paint helped turn the animals away.

At the close of the pasturing season he brought the cattleguard into the project garage and parked the back wheels of a truck on the grill most of last winter to test the life of the springs. They showed no apparent loss of elasticity from this extremely long period in a stretched position.

Many water users in eastern Oregon are building their own cattleguards, and the Vale Oregon and Warm Springs Irrigation Districts foresee the time when their ditch operators will no longer be plagued with the time-consuming job of opening and closing gates on canal and lateral rights-of-way.

Irrigation Districts and farmers elsewhere may find that Manager White has presented the answer to a troublesome and costly problem. Modification may be desirable to meet specific needs but the over-all plan merits consideration and trial. ###

First Contract Let for Webster Dam

Foundation excavation work for Webster Dam on the south fork of the Solomon River near the village of Webster, Rooks County, north central Kansas, is now under way under the terms of a Bureau of Reclamation contract awarded in November 1952 to the H. N. Rodgers and Sons Co., Memphis, Tenn., on a low bid of $993,870.

The contract, first to be awarded on the Webster Unit, Solomon Division of the Missouri River Basin project, calls for the excavation of more than 1¾ million cubic yards of earth, the placement of more than 1¼ million cubic yards of earth, sand and gravel fill, and diversion of the river during construction. The job must be completed by January 1954 (or in 380 days).

The 2-mile long, 108-foot high Webster Dam to be constructed under additional contracts yet to be awarded, will, when completed, serve as one of the three key water control structures designed to check the recurring disastrous floods on the Solomon River and at Kansas City and other points in the Kansas River Basin.

The rolled earth-fill dam in the Webster Unit, besides providing storage space for 270,000 acre-feet of flood water, will facilitate the ultimate irrigation of 9,000 acres of land in the Solomon River Valley, as well as furnish important recreational and fish and wildlife protection benefits in the region.

The Bureau of Reclamation is doing everything possible to help the people of Webster, Kans., whose property has been acquired for construction of the dam. Early in the year, the Bureau granted an extension of time from March 15 to May 15, 1953, for relinquishing possession of this property so the children could complete their school year in the existing buildings. Some of the buildings and homes will be moved to new sites. Other families will abandon their buildings and receive salvage value compensation from the Bureau. #

VICE PRESIDENT ROLAND EARHART of the Willwood Irrigation District, Shoshone project, Wyoming, takes the floor during the 5th annual meeting of water users and Reclamation officials in Region 6. Bureau officials seated at the table (l. to r.) are Regional Director K. F. Vernon and assistant Regional Director W. E. Rawlings, both of Billings, Mont., and E. D. Eaton of Washington, D. C., Director, Operation and Maintenance Division. More than 60 farmers from 11 projects in the Region 6 area attended the meeting.

WATER USERS HAVE THE FLOOR

At the fifth annual meeting of the stockholders in Region 6, the irrigation water users dominated the discussions. More than 60 farmers representing 17,000 irrigation water users on 11 projects served by Reclamation-constructed works in Montana, North Dakota, South Dakota, and Wyoming (the Region 6 area) were on hand to lead the discussions and air their problems during a two-day meeting with Bureau of Reclamation officials and specialists at Billings, Mont., January 8 and 9, 1953.

The projects represented included the Belle Fourche in South Dakota, Buford-Trenton in North Dakota, Lower Yellowstone in Montana and North Dakota, Intake, Buffalo Rapids, First and Second Divisions, Huntley, Milk River, and Sun River in Montana, and the Riverton and Shoshone in Wyoming. Representatives were also on hand from two units of the Missouri River Basin project; the Savage Unit in Montana which went into operation in 1950, and the Angostura Unit in South Dakota on which some lands were served with water for the 1952 crop season. Work is now progressing to make possible the irrigation of the entire 12,000-acre Angostura Unit in 1953.

This 1953 program was specifically designed to bring about active participation of individual water users in the deliberations of the conference. Water users led discussions, including reports of project operations in 1952, drainage problems, canal lining and its results, effective weed-control program, crop census reports, and the effectiveness of water-user management on project operations.

In contrast to previous meetings which dealt with ironing out local administrative difficulties and technical aspects of project operations, a large part of this year's program was devoted to the needs for new or amendatory legislation, particularly as it relates to multiple purpose uses of the presently operating projects, retention of a percentage of the mineral rights on lands of affected irrigation districts, and the use and management of Reclamation withdrawn or acquired lands.

One of the highlights of the meeting was the presentation of a report by the Huntley Project Future Farmers of America Chapter relative to on-farm water use studies conducted on their farms in 1952. The report was given by F. F. A.

(Please turn to page 67)

PROTECTION FOR PLYWOOD

by M. R. SPINDLER, Engineer,
Design and Construction Division
Denver, Colo.

HERE'S GOOD NEWS for the water user who has trouble keeping his plywood buildings looking spic and span. Engineers and technicians in the Bureau of Reclamation laboratories in Denver, Colo., have found a way to cut down on that troublesome—and expensive—problem of checking and layer-separation which occurs when paint applied on plywood cracks or buckles.

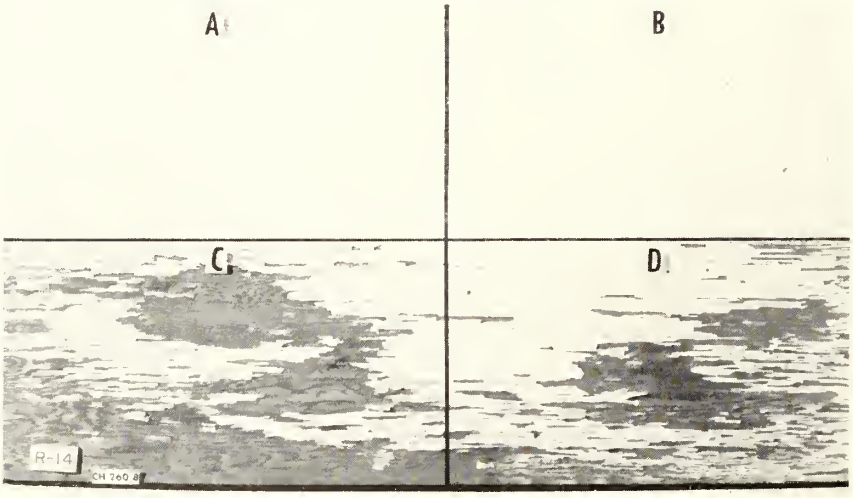
Eighteen months ago the paint specialists in the laboratories got an appeal for help from one of the Bureau's construction camps. Ordinary paint jobs were not providing adequate protection for prefabricated plywood structures in use there.

The engineers tackled the problem of surface protection for plywood by testing eight different measures which appeared to have promise. They marked off a 4- by 8-foot sheet of ordinary plywood into 32 1-foot squares. Each of the eight coatings was applied to four different squares to compensate for local differences in the wood. The test board was exposed to the ravages of wind, sun, rain, snow, freezing, and thawing atop the laboratory building at the Denver Federal Center. For a year and a half the panel remained on the roof.

When it was taken in for final examination, one of the coatings was still in excellent condition. The two second-best each appear to have given equal results.

The best protection was gained by first applying a coat of top-quality outside white house paint, thinned with 1 pint of raw linseed oil per gallon of paint. Two coats of unthinned outside white were applied after the primer was dry.

Two of the tested coatings gave second-best performance. On one of these, the primer was a standard outside house paint. The other primer was a low-viscosity varnish, fortified with a fungicide to forestall mold damage. In each instance, the primer was topped with two coats of high-quality outside white.



AFTER 26 MONTHS OF WEATHERING (following 3 months of weathering before the four coatings were applied) this sheet of plywood demonstrated the qualities of (A) an undercoater for outside house paint, reduced with spar varnish—four parts of undercoater to one part of varnish, (B) spar varnish, (C) shellac, and (D) commercial knot sealer. *Photo by W. M. Batts, Denver, Colo.*

What to do about your plywood surfaces which are already checking? The paint laboratory people believe they have an answer to this problem, too. They have tested two maintenance coatings, paste wood filler and white lead-in-oil paste. So far, the white lead-in-oil paste has effectively sealed the checks and provided a sound, smooth base to which paint may be applied. The paste-wood filler does not seem to be flexible enough and shows no advantages for this use. Paint alone will not prevent further checking because the paint film will not bridge the checks to provide a continuous coating.

All materials used in the tests conform to Federal specifications, and were applied according to methods described in the PAINT MANUAL, a Bureau publication used as a guide to the selection and application of coatings for wood, metal, and other surfaces. Where paints conforming to the Federal specifications are not available, a second-best choice is to use only that furnished by an established, reliable paint company.

If you are interested in learning more about methods of using paint for protection, you can get the PAINT MANUAL for $1.25, either by writing

to the Superintendent of Documents, Washington 25, D. C., or the Bureau of Reclamation, Supply Field Division, attention 841, Building 53, Denver Federal Center, Denver 2, Colo. ###

Water Users Have the Floor

(Continued from page 65)

members Edward Reiter and John Reed who studied irrigation efficiencies by measuring irrigation water delivered to the farm, and runoff water leaving the farm during the 1952 crop season.

The irrigation farmers passed two resolutions. One proposed that land withdrawn or acquired for Reclamation purposes that is not a part of the farm units should be retained under withdrawal by the Bureau for the benefit of the water users. The second resolution supported legislation which would provide a more equitable division of mineral rights on the Reclamation farms.

Water users were brought up to date on the prospects of an adequate water supply for 1953 by a report, entitled, "Value of Snow Survey to the Irrigation District," given by A. R. Codd of Bozeman, Mont., hydraulic engineer for the Soil Conservation Service. Stanley Howard, also of Bozeman, an irrigation specialist for Montana State College, gave a review of methods for efficent use of water on the farm. Highlighting the two luncheon meetings were talks by H. L. Buck of Billings, treasurer and Montana director for the National Reclamation Association, and Tom Barnes of Billings, a geologist for the Shell Oil Company. # # #

Kirwin Dam To Be Completed in 1955

During the latter part of January, the Texas Construction Company, Dallas, Tex., was awarded the contract, on a low bid of $6,729,670.80, to complete construction of Kirwin Dam in Phillips County, Kans., by December 1955. (See article entitled, "Kirwin at the Crossroads" in the August 1952 issue of the RECLAMATION ERA.)

The construction contract award stipulated that work on completion of the dam must be begun within 30 days, and completed in 1,050 days.

The Texas Construction Company's proposal was the lowest among 15 bids submitted for the work. The competition for the contract, with prices ranging upwards to 12 million dollars, resulted in an unusually advantageous deal for the Government. #

Record-Making Repayment Contract Sparks Weber Basin Project

SIGNING THE WEBER BASIN REPAYMENT CONTRACT.—From l. to r., W. Rulon White, president, Weber Basin Water Conservancy District; Assistant Commissioner of Reclamation Harvey F. McPhail (witnessing the signatures); E. O. Larson, Region 4 Director, and E. J. Fjeldsted, manager, Weber Basin Water Conservancy District.

Reclamation's largest single repayment contract was executed December 12, 1952, in Ogden, Utah, when the president of the Weber Basin Water Conservancy District, W. R. White, and Regional Director E. O. Larson of the Bureau of Reclamation, acting under delegation of authority from the Secretary of the Interior, signed a $57,694,000 contract for repayment of the reimbursable costs of the multiple-purpose Weber Basin project, Utah.

Qualified voters of the district, comprising four counties in northern Utah, had previously authorized the District to enter into the contract. In the December 6, 1952, special election, the ratio of voting was 5 to 1 in favor of undertaking the huge obligation. The repayment period is 60 years.

Four days after the election, authorizing execution of the repayment contract, a $2,486,613 construction contract was awarded by the Chief Engineer to Utah Construction Company for construction of 3.3-mile Gateway Tunnel. The tunnel is the first unit of construction under the Weber Basin project which is the largest reclamation project in Utah history and the largest of the 10 reclamation projects authorized by the 82d Congress on July 9, 1952.

Before the Weber Basin project repayment contract was signed, the $42,000,000 repayment contract for the Wellton-Mohawk Division of the Gila project in southwestern Arizona enjoyed the honor of being Reclamation's largest single repayment pact.

The Weber Basin project will irrigate 50,000 acres of new lands, plus 24,000 acres now receiving an inadequate water supply, and supply municipal water to more than 20 communities and 3 permanent military bases between Salt Lake City and Ogden. The $70,000,000 project will provide 40,000 acre feet of new water each year for municipal, industrial, and military use, eliminate serious flood problems, reclaim waterlogged land, generate hydroelectric energy for irrigation pumping, improve fish and wildlife conditions, and provide recreational benefits.

Construction was officially started on January 9, 1953. (See photos on page 54 of this issue.) #

Ohio and Minnesota Firms Win Contract for Yakima Generators and Turbines

As the initial step in constructing the Kennewick Division of the Yakima project in the State of Washington, contracts were awarded in December to the James Leffel Company of Springfield, Ohio, and the Electric Machinery Manufacturing Company of Minneapolis, Minn., for the manufacture and installation of hydroelectric generators and the manufacture of hydraulic turbines for the new Chandler Power and Pumping Plant near Prosser, Wash. This is the eighth of the ten Reclamation projects to get under way since July 1, 1952, on which construction was authorized by the 82d Congress.

Under the Bureau of Reclamation contracts, the Minneapolis firm won the award for the two 6,000-kilowatt generators, on a low bid of $284,093. The Ohio firm won their contract on low bids of $284,977 for the two 8,500-horsepower turbines to be connected with the electric generators, and $127,490 for the two 2,600-horsepower turbines to be connected with hydraulic pumps in the Chandler plant.

Both contracts stipulate that the time of delivery is important and require that the pump turbines be shipped by August 1954 (610 days), the turbines for the generators two months later (October 1954, or 670 days from the date of the award) and the two generators by February 1955 (in 780 days). According to the schedule the first gen-

erator is to be completely installed by June 1955 and the second generator 2 months later, or by August 1955.

A contract for performing all work for the construction of earthwork, concrete lining and structures on the Chandler Canal also has been awarded to J. A. Terteling & Sons, Boise, Idaho, on a low bid of $1,613,278.60. Under the award the canal construction work would be completed in 750 days, or by February 1955.

Construction contracts were awarded as soon as possible after voters of the Kennewick Irrigation District held a special election on December 30, 1952, and voted to ratify a contract to reimburse the Federal Government for that part of the project costs to be repayed by irrigation. As required by special Federal legislation authorizing the project, the Federal Government will receive $12,516,300 in construction costs from power and irrigation revenues, of which the water users, under the proposed contract, would repay $4,809,700 over a 66-year period, including a 10-year development period for new lands. Total cost of the project is estimated at $13,520,800, which includes an allocation of $588,700 of the cost of existing storage reservoirs for the Yakima project. Of this amount, $1,041,400 was allocated to fish and wildlife benefits from the project, and is not to be repaid from irrigation and power revenues.

During the 6-month irrigation season the power canal will be used primarily for irrigation, although at least half the canal capacity will be available for power. During the 6 winter months, when the canal is not used for irrigation, the entire canal capacity and divertible flow will be available for power production. For this reason, it has been concluded that 30 percent of the joint project maintenance costs for the Prosser Dam and the Prosser-Chandler Power Canal shall be allocated to irrigation and 70 percent to power.

Development of the Kennewick Division was authorized because of the loss of about 7,000 acres of irrigated farm land from the Richland Irrigation District where the city of Richland now is located. This is the administrative, business, and housing headquarters for one of the Atomic Energy Commission's plants located at Hanford. This plant was constructed during World War II, is now in full operation, and has continuously carried on a vigorous construction program. This loss of 7,000 acres, together with the encroachment of urban population upon irrigated farm lands adjoining the city of Kennewick, has resulted in at least a 50 percent reduction in the supply of agricultural products available for processing in local plants. In addition, McNary Dam, now under construction by the Corps of Engineers and located on the Columbia River 29 miles downstream from Kennewick, is scheduled for completion in 1953. The backwaters from this dam will inundate another 1,533 acres of croplands now irrigated southeast of Kennewick.

Establishment of the Hanford Atomic Energy Works has added approximately 50,000 people in the Tri-City communities of Richland, Kennewick, and Pasco, thereby creating an excellent local market for agricultural products.

The Kennewick Division will provide around 425 new farm opportunities for veterans and other interested parties. The power system will furnish required power for irrigation pumping, and during the non-irrigation season and off-peak irrigation months, substantial quantities of surplus power will be available for commercial distribution.

The plan for immediate development of the Kennewick Division involves the construction of an irrigation system to serve a gross area of 18,871 acres, a hydraulic pumping plant to lift water into the main canal of the irrigation system, and a hydroelectric power plant with 12,000 kilowatts installed capacity. #

AT DAVIS DAM DEDICATION.—Mrs. Arthur Powell Davis and Region 3 Director, E. G. Nielsen, examine the bronze memorial plaque honoring Arthur Powell Davis, for many years chief engineer and Director of the Reclamation Service, who planned the present development of the Lower Colorado River through the construction of four high dams—Hoover, Parker, Imperial, and Davis. By a happy coincidence, Mrs. Davis, widow of the famed engineer, also celebrated her birthday on the day of the dedication, December 10, 1952. Arthur Powell Davis' nomination to Reclamation's Hall of Fame appears in the February 1950 issue of the RECLAMATION ERA.

CROPS

High Crop Values in California and Oregon

According to a preliminary report from the Bureau of Reclamation's Region 2 headquarters at Sacramento, Calif., irrigation farmers who received all or part of their irrigation water supply from Bureau of Reclamation sources in California and Southern Oregon raised crops valued at $190,309,732 in 1952.

These crops were produced on the Klamath project in southern Oregon and northern California, the Orland project in northern California, and in various areas of the San Joaquin Valley and Delta area of California which are served by the Central Valley project.

Bureau of Reclamation water deliveries in 1952 represent about half of the total crop requirements of 38 irrigation and water districts being served by the Central Valley project. All water needs of the Klamath and Orland projects are met through project deliveries.

Cotton was the most important single crop raised in these areas, both from a standpoint of acreage planted and cash value. Irrigation districts which received a supplemental water supply from CVP raised 413,000 bales, or 23 percent of all cotton raised in California. Its cash value, including both lint and seed, was $84,547,000.

The next most valuable crop raised in the project areas was fruit and nuts, with a cash value of $33,834,744, produced on 123,044 acres.

The third ranking crop from a standpoint of financial return was potatoes, with a total Region 2 value of $24,343,342, the report to the regional director stated.

With 590,776 acres under supplemental irrigation from reclamation sources, the Central Valley project area had the highest cash return on its vast variety of crops, or $155,731,000.

The Klamath project, with 187,000 acres irrigated from reclamation sources in California and Oregon, produced crops valued at $30,758,000.

Orland project farmers produced crops valued at $1,819,000, grown on 17,160 acres in California's oldest reclamation project, the preliminary report stated. #

Belle Fourche 1952 Crops Worth Almost Half Project Cost

Crops raised on the Belle Fourche project in South Dakota in 1951 had a gross value of $2,238,136. This represented an increase of $246,622 over the 1950 return or an average of $42.98 per acre for 1951 as compared with $36.36 per acre in 1950. The estimated value of crops grown on the project in 1952 is $2,350,000 which is 47 percent of the total cost of the project to date. In other words, in 1 year, irrigation farmers on the Belle Fourche project, raised crops with a gross value equal to almost half the total Federal investment in constructing the project so far.

LETTERS

Thank You, Admiral!

President's Committee on Employment
of the Physically Handicapped,
U. S. Department of Labor.

Washington, D. C., October 28, 1952.

DEAR EDITOR: Your October issue of "The Reclamation Era" publication has been reviewed with much interest. It is full of interesting subjects.

We were especially interested in your story on pages 237–238 entitled "Ready, Willing, and Able." It has always proved effective to do a story of an individual in your own organization. In this case you have selected a very interesting success story of a handicapped person.

It was also interesting to note your treatment of disabled veterans along with handicapped nonveterans who are working on the Columbia Basin project.

Thank you for your second year in a row of cooperation and a fine contribution to the physically handicapped program.

Cordially,

Ross T McIntire,
Chairman.

Cordiality From Colombia

BOGOTA, *July 1, 1952.*

BUREAU OF RECLAMATION,
DEPARTMENT OF INTERIOR,
Washington, D. C.

GENTLEMEN: In the name of the institute which I manage, permit me to send you my most cordial congratulations on the completion of the fiftieth anniversary of work on the great projects of land irrigation and power generation carried out in the United States during those 50 years of life.

I also acknowledge my gratitude for the attention, information, and instruction received in the International Reclamation Conference held in the Columbia River Basin at which conference I represented the Republic of Colombia.

The said instructions and information obtained in the Columbia Basin are of great usefulness in Colombia for our projects in engineering and electrification.

The magnificent and marvelous work performed by the Bureau of Reclamation for the benefit and greatness of the people of the United States and as an example and instruction of humanity constitute a stimulus and spur for nations beginning to develop.

Very sincerely,

Instituto Nacional De Approvechamiento De Aguas Y Fomento Electrico
JULIAN COCK A., *Manager.*

RECLAMATION ERA *readers may recall the article entitled, "Welcome Stranger!" which appeared on page 200 of the August 1952 issue. The above letter was received too late to appear in connection with the article—Ed.*

A Bell Letter

The following letter indicates that westerners as well as the RECLAMATION ERA *"get around."*

To new reader Bell and all others interested in Reclamation, the yearly subscription cost of the RECLAMATION ERA *is $1.50 for 12 issues a year, with a special rate for Bureau of Reclamation employees, and members of water user organizations which work with the Bureau of Reclamation in its job of western water resource development.*

35 LEWIS AVENUE,
BILLINGS, MONT.,
October 18, 1952.

DEAR MRS. SADLER: Have just returned after spending the day at Grand Coulee Dam and while there saw your publication RECLAMATION ERA, October 1952 issue which tells the effect of Hungry Horse Dam on the Columbia River projects.

Please send me a copy of the October issue and put me on your mailing list telling me the cost.

Sincerely yours,

G. A. W. BELL, Jr.

Sunny Sentiment From Sunnyside

Box 22,
SUNNYSIDE, WASH.,
September 8, 1952.

DEAR MRS. SADLER: Please send me the September issue, because I do not want to miss even one issue. I enjoy the "ERA" and get much good from it.

Thank you,

QUENTIN G. GOODWIN.

A Good Investment

CHURCHMAN INVESTMENT CO.,
112 North Fourth Street,
Pasco, Wash.,
September 23, 1952.

DEAR MRS. SADLER: Your article, "Columbia Basin's Showplace," in the September 1952 issue of the RECLAMATION ERA, to the writer is most interesting, and I should like to pass on a few copies to my friends and clients.

Very truly yours,

E. T. CHURCHMAN.

Congressman Hallauer and Hungry Horse

House of Representatives
State of Washington
Thirty-second Legislature

OROVILLE, WASH.
January 2, 1953.

DEAR MRS. SADLER: In your October 1952 issue an excellent article entitled "The Down Stream Dynamics of Hungry Horse" appeared. This article and the accompanying picturegraph was very easy to understand.

I think it would be of considerable interest in the Northwest if similar articles could be carried explaining in similar simple fashion the results anticipated from Libby, Hells Canyon, and other multipurpose projects now in the planning stage.

Yours truly,

WILBUR G. HALLAUER,
State Representative,
1st District.

RELEASES

Seven-Year Reclamation Program Reported to New Congress

A 7-year program for the continued development of the West's water resources which is designed to supply new or supplemental irrigation water to 3,111,700 acres of land and the installation of 2,866,500 kilowatts of hydroelectric generating capacity was forwarded to the Eighty-third Congress during the first week in January.

The submittal was made in response to a request from the chairman of the House Interior and Insular Affairs Committee of the last Congress that a "factual, concise and current reference on Federal Reclamation" be made available to the Committee of the incoming Congress. A similar request was fulfilled for the Eighty-first Congress. Information contained in the report can provide Congress with the frame-development of natural and water resources.

The program includes presently authorized reclamation projects, many of which are already in the construction stage, some on which preliminary investigations have been completed and are ready for submittal to Congress, and others which are still in the planning stage. The entire program is designed to accomplish the greatest results at the most economic rate of progress and is contingent upon future authorization of some projects and appropriations made by the Congress. Many of the projects listed for investigation are not planned for construction within the 7-year program. A copy of the report, entitled "The Reclamation Program, 1953–59" is available upon request to the Bureau of Reclamation, Washington 25, D. C. #

Report to the Stockholders

Celebrating its Golden Jubilee, the Bureau of Reclamation has published a Financial Report covering 50 years of reclamation in the 17 Western States.

For the first time, the financial activities of the Bureau over the past 50 years are published on a consolidated basis. The report presents an interesting story on the Government's investment, its accomplishments, and its plans for the future. It tells the story of what the Bureau has done with over 2 billion dollars—converting it into a water supply for over 6 million acres of fertile arid lands and providing more than 4 million kilowatts of electric generating capacity to serve the farms, homes, and industries of the West. It also shows how the Government will recover its investment through power revenues and repayment contracts on irrigation works.

The report entitled, "50 Years of Reclamation" will be of great interest to those concerned with reclamation in the West and copies may be secured without charge at the Washington and Regional Offices of the Bureau of Reclamation. #

Corrections on Columbia Basin Story

We received the following corrections for the article entitled, "Operating the Columbia Basin Project," too late to correct the February 1953 issue. On page 32, second paragraph, instead of 15 years to construct canals and laterals for irrigating the first 500,000 acres, change it to 5 years. According to the 7-year program, facilities for irrigating this acreage should be complete by the end of 1958. In paragraph 4, line 5, the Burbank acreage should be changed to 1,200 acres, instead of 1,600. On page 34, line 3, the word "gatetender" should be substituted for "watermaster." On the same page, next paragraph, top line, insert the word "or" so the sentence reads "deep, or swiftly flowing water." #

As this issue goes to press, Secretary of the Interior, Douglas McKay, has authorized Assistant Secretary of the Interior, Fred G. Aandahl, to exercise all of the authority and perform all of the functions of the Commissioner of Reclamation. Aandahl, former Governor of the State of North Dakota, was confirmed and designated as Assistant Secretary of the Interior for Water and Power Development on February 10, 1953.

In pursuance of Secretary McKay's instructions, Assistant Secretary Aandahl designated Assistant Commissioner of Reclamation, Goodrich W. Lineweaver, to be responsible, under his direction, for the coordination and supervision of Bureau of Reclamation activities on February 12, 1953.

The resignation of Commissioner of Reclamation, Michael W. Straus, was accepted by President of the United States, Dwight D. Eisenhower, as of the close of business, February 6, 1953.

NOTES FOR CONTRACTORS

Contracts Awarded During January 1953

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contrac amount
DC-3752	Missouri River Basin, Mont	Jan. 7	Completion of Canyon Ferry Dam, power plant, and switchyard.	Eisenman, Seabrook, and Elliott, Chula Vista, Calif.	$694,1
DS-3800	Central Valley, Calif	Jan. 12	Three 3,000-ampere generator-voltage bus structures with current and potential transformers, generator-protective equipment, grounding and disconnecting switches for Folsom power plant.	I-T-E Circuit Breaker Co., Philadelphia, Pa.	140,5
DS-3824	do	Jan. 8	One 600-kilovolt-ampere unit substation and one 460-volt power distribution board for Nimbus power plant.	Northeastern Engineering, Inc., Manchester, N. H.	19,4
DS-3828	Boulder Canyon, Ariz.-Calif.-Nev	Jan. 13	Seven vertical-shaft, turbine-type pumping units for L-1, L-2, and L-3 pumping plants, Coachella Valley distribution system, unit 8, schedule 1.	Fairbanks Morse & Co., Kansas City, Mo.	20,2
DS-3829	Gila, Ariz	Jan. 2	Five vertical-shaft, centrifugal or mixed flow pumps for pumping plants Nos. 1, 2, and 3, Wellton-Mohawk Canal.	Worthington Corp., Harrison, N. J.	178,6
DS-3833	Missouri River Basin, Iowa	Jan. 8	One 40,000/53,333/66,667-kilovolt-ampere autotransformer with lightning arresters for Sioux City substation.	American Elin Corp., New York, N. Y.	100,8
DS-3837	Columbia Basin, Wash	Jan. 30	16 horizontal-shaft, centrifugal-type pumping units for Warden, North Warden, Warden relift, East Low 61, East Low 61.7, and East Low 63.1E pumping plants, Area E-5, East Low canal laterals.	Economy Pumps, Inc., Division of C. H. Wheeler Mfg. Co., Philadelphia, Pa.	105,9
DC-3840	Yakima, Wash	Jan 6	Construction of earthwork, concrete canal lining, and structures for Chandler Canal.	J. A. Terteling and Sons, Inc., Boise, Idaho.	1,613,2
DC-3841	Missouri River Basin, Nebr.-Kans	Jan. 2	Construction of earthwork, concrete canal lining, and structures for Courtland Canal.	Platte Valley Construction Co., Grand Island, Nebr.	269,5
DS-3842	Gila, Ariz	Jan. 8	Five 72-inch diameter flap gates for Wellton-Mohawk Canal pumping plants Nos. 1, 2, and 3.	Columbia Machine Works, Berkeley, Calif.	26,4
DS-3843	Central Valley, Calif	Jan. 2	One 2-foot 9-inch by 2-foot 9-inch high-pressure gate with one 49,000-pound hydraulic hoist, 2 conduit-lining transitions, and 1 gate hanger for outlet works at Sly Park Dam.	Monarch Forge & Machine Works, Portland, Oreg.	13,2
DC-3844	Missouri River Basin, Kans	Jan. 20	Completion of Kirwin Dam	Texas Construction Co., Dallas, Tex	6,729,6
DC-3845	Columbia Basin, Wash	Jan. 15	Construction of earthwork, pipelines, and structures for Area P-8 laterals sublaterals, and wasteways, Potholes East canal laterals, schedule 1.	Osberg Construction Co., Seattle, Wash.	1,164,9
DS-3846	Central Valley, Calif	Jan. 28	Four 2,500-volt motor-control equipment assemblies with control switches for the fifth pumping unit at each of the Contra Costa Canal pumping plants Nos. 1, 2, 3, and 4.	Gough Industries, Inc., Los Angeles, Calif.	16,0
DS-3848	do	do	Steel structures for transformer circuits and switchyard at Folsom power plant and transformer structures at Nimbus power plant.	Emseo Mfg. Co. (formerly Emsco Derrick & Equipment Co.), Los Angeles, Calif.	52,4
DC-3849	Missouri River Basin, S. Dak	Jan. 7	Construction of Weaver substation	D. L. Varney, Inc., Omaha, Nebr	33,8
DC-3852	Columbia Basin, Wash	do	Drilling for stabilization of right bank at Grand Coulee Dam.	Service Hardware & Implement Co., Tacoma, Wash.	73,7
DC-3853	Central Valley, Calif	Jan. 8	Construction of Camp Creek Diversion Dam and access road.	Stolte, Inc., Oakland, Calif	99,3
DS-3854	do	Jan. 16	Eight vertical traveling water screens for Delano-Earlimart irrigation district, unit 2, Friant-Kern canal distribution system.	Link-Belt Co., San Francisco, Calif	77,0
DC-3856	Rio Grande, New Mexico-Tex	Jan. 19	Construction of Picacho Arroyo Control North Branch Dam.	Pecos Valley Construction Co., Carlsbad, N. Mex.	66,2
DC-3862	Middle Rio Grande, N. Mex	do	Channelization of the Rio Grande in Bernardo area.	Miller & Smith, Albuquerque, N. Mex.	57,8
117C-176	Columbia Basin, Wash	Jan. 12	Distribution system, part-time farm units PT 1 and 2.	McWaters and Bartlett, Boise, Idaho	22,2
117C-177	do	do	Lining repair, East Low canal, Station 1244 to Station 1410.	Intrusion Prepakt, Inc., Seattle, Wash	20,4
200C-221	Central Valley, Calif	Jan. 7	Roads, drainage, and landscaping for Tracy Pumping Plant and switchyard.	Paul E. Woof, Fresno, Calif	117,9
300C-47	Boulder Canyon, Calif	Jan. 5	Reconstruction of railroad crossing, Coachella Valley Distribution System.	Norman I. Fadel, N. Hollywood, Calif.	68,5

Construction and Materials for Which Bids Will Be Requested by May 1953

Project	Description of work or material
Boulder Canyon, Calif	Construction of 10 miles of concrete pipe laterals, 4 pumping plants of 59 to 8 cubic feet per second capacities, and 2 equalizing reservoirs, part 2 of unit 8, Coachella distribution system, adjacent to the Coachella canal southwest of Indio, Calif.
Central Valley, Calif	Eight vertical-shaft, motor-driven, turbine-type pumping units having capacities ranging from 2 to 9 cubic feet per second and heads ranging from 38 to 93 feet; and 8 vertical-shaft, motor-driven, propeller-type pumping units, capacities and heads to be determined later, for Plainview irrigation district.
Colorado-Big Thompson, Colo.	Construction of 12.5-mile 200-cubic feet per second Boulder Creek supply canal, an earth structure to
Colorado-Big Thompson, Colo.—Continued	convey water from the St. Vrain supply canal Boulder Creek.
Do	Installation of 1 transformer for Gunnison substatic
Colorado River Front Work and Levee System, Calif.	Fabricate, assemble, and launch 1 steel-hull, dies powered tugboat, complete with equipment a machinery, for towing 670-ton dredge on the C orado River, near Needles, Calif.
Columbia Basin, Wash	Construction of 6 pumping plants and installati of the pumping units for lateral Area E-5 on E Low canal, near Warden, Wash. Also furni and lay 2 miles of 18- to 60-inch diameter reinforce concrete pressure pipe, steel pipe, and inst electrical equipment.
Do	Construction of 85 miles of Area E-5 laterals, st

Construction and Materials for Which Bids Will Be Requested by May 1953—Continued

Project	Description of work or material
Columbia Basin, Wash.—Continued	laterals, and wasteways, varying from 350 to 2 cubic feet per second capacities.
Do	Construction of 35 miles of unlined laterals, sublaterals, and wasteways, varying from 2 to 50 cubic feet per second capacities, for Area W–7 on West canal, near Quincy, Wash.
Do	Construction of 1 mile of unlined 250 cubic feet per second ditch, an extension to the PE16.4M12 wasteway in lateral Area P–1 on Potholes East canal, 9 miles west of Othello, Wash.
Do	Construction of 60 miles of laterals of 12 to 2 cubic feet per second capacities, 6 miles of wasteways, and 5 outdoor-type pumping plants for Area P–9 on Potholes East canal, 10 miles north of Richland, Wash.
Do	Eight automatic radial gates, capable of discharging variable amounts of water from 7 to 21 cubic feet per second. Designs are to be supplied by the contractor.
Davis Dam, Ariz	Erecting steel structures and installing electrical equipment for Knob substation, 8 miles west of Yuma, Ariz.
Deschutes, Oreg	Construction of cattleguards for the North Unit lateral system, near Madras, Oreg.
Eden, Wyo	Construction of Prospect diversion dam and canal, near Farson, Wyo., will include 225 feet of earth dike, a rock weir 4 feet high and 70 feet long, and 0.5 mile of 150 cubic feet per second Prospect canal.
Gila, Ariz	Construction of the Water Users Administration Building is to be a pumice block, nonbasement structure, 9,160 square feet in floor area, for Wellton-Mohawk division located 1.5 miles east of Wellton, Ariz. Furnishing and installing a refrigerated air-conditioning system.
Do	Construction of 2.4 miles of 220 cubic feet per second Dome canal and 2.6 miles of 100 cubic feet per second lateral D–1.4E, near Dome, Ariz.
Do	Construction of 22 miles of unreinforced concrete lined laterals and sublaterals of 45 to 15 cubic feet per second capacities for Unit 4 of Mohawk distribution system, near Wellton, Ariz.
Kendrick, Wyo	Making necessary repairs on existing ditch rider's house at Alcova Dam Government camp; and dismantling, moving from Kortes Government camp, and reereeting 1 prefabricated residence.
Minidoka, Idaho	Constructing laterals from irrigation wells on the North Side pumping division, near Rupert, Idaho.
Do	Drilling and casing 20 irrigation wells on the North Side pumping division, near Rupert, Idaho.
Missouri River Basin, Iowa.	Main control board, distribution boards, and battery charges for Sioux City substation.
Missouri River Basin, Mont.	Construction of 2,500-kilovolt-ampere Crow Creek substation and 0.4 mile of 4.16-kilovolt-ampere distribution line, 4 miles south of Toston, Mont.
Do	One 920-foot long, 52-inch inside diameter, steel discharge pipe for Crow Creek pumping plant.
Do	One 115-kilovolt, 800-ampere, 1,500-megavolt-ampere oil circuit breaker for Little Porcupine switchyard.
Do	One 300-kilovolt-ampere, 3-phase, 34,400 delta-480 grounded wye-volt, self-cooled power transformer for Little Porcupine switchyard.
Missouri River Basin, Nebr.	Construction of 18 miles of unlined Cambridge canal's fourth section, including drains and channel changes with appurtenant reinforced concrete structures. Canal ranges in capacity from 125 to 30 cubic feet per second.
Do	Construction of 7 miles of unlined laterals ranging from 12 to 6 cubic feet per second capacity, with appurtenant reinforced concrete structures for the second section of Cambridge canal.
Missouri River Basin, N. Dak.	Placing footings, erecting about 20 steel towers, furnishing materials and stringing aluminum conductors and steel overhead ground wires for the extension of Garrison-Bismarck double-circuit 230-kilovolt transmission line into Garrison switchyard. Placing footings, erecting 1 steel tower, furnishing and stringing aluminum conductors and steel overhead ground wires for the extension of Williston-Garrison 115-kilovolt transmission line into Garrison switchyard.
Palisades, Idaho	The Snake River bridge is to be a 3-span continuous deck plate girder bridge, with end spans 136 feet center to center of bearings and the center span 264 feet, for the Wyoming State Highway.
Do	One autotransformer, 115- to 69-kilovolt with 12.5-kilovolt tertiary, 5,000-kilovolt-ampere, self-cooled, with tank-mounted lightning arresters and a grounding transformer.
Do	Seven 115-kilovolt, 1,200-ampere, 3,500-megavolt-ampere, 3-pole, and 1 69-kilovolt, 600-ampere, 1,000-megavolt-ampere, 3-pole oil circuit breakers for Palisades switchyard.
Do	One metal-clad unit switchgear which includes 2 15-kilovolt, 600-ampere, 250-megavolt-ampere air circuit breakers for Palisades switchyard.
Riverton, Wyo	Excavation of intercepting ditches for drainage purposes near Riverton, Wyo.
Do	Conversion of Pilot Butte power plant to semiautomatic operation.

United States Department of the Interior, Douglas McKay, Secretary

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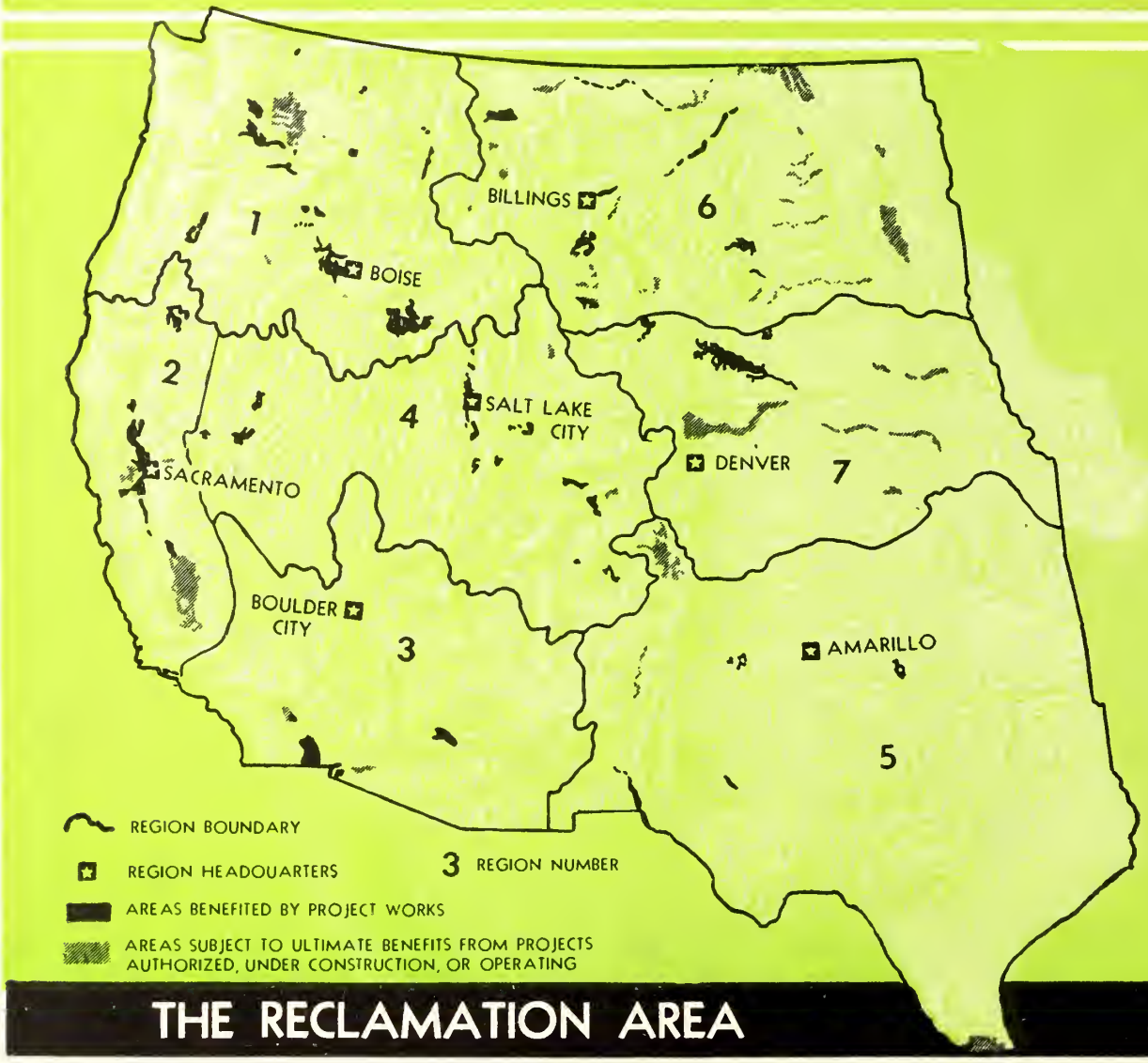

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The Reclamation Era

Official Publication of the Bureau of Reclamation

April

1953

IN THIS ISSUE:

April 1953

Volume 39, No. 4

The Reclamation ERA

35 Years Ago In The Era

WAYS TO BETTER DAIRYING

Better results in dairying, according to specialists of the United States Department of Agriculture, may be secured by proper sanitation and care in producing and handling milk; by better care and utilization of pastures; by raising on the farm adequate supplies of roughage, particularly legumes—alfalfa hay on the projects—and silage to take the place of grains so far as is practicable; by preserving for dairy purposes all the high-producing animals and eliminating those that are inefficient; by feeding according to production so as to secure the greatest yield of milk with the least quantity of feed, which necessitates a record of production of individual cows; by the full utilization in the community of good bulls throughout the entire period of their usefulness and to their full capacity; and by the prompt control of disease.

(From an article on page 148 of the April 1918 issue of the RECLAMATION RECORD, predecessor to the RECLAMATION ERA.)

OUR FRONT COVER. Miss La Quita Corbett, who is admiring the pretty blossoms which bring wealth to irrigation farmers through seed production. This photo was taken on the North Unit of the Deschutes project in Oregon by Phil Merritt, Region 1.

OUR BACK COVER is based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners Kittredge and Coolidge.

DESIGN AND ILLUSTRATIONS by Graphics Section, Bureau of Reclamation, Washington, D. C.

R. F. Sadler, Editor

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In this issue . . .

RECLAMATION PLACE NAMES IN THIS ISSUE

NITROGEN IN THE WEST

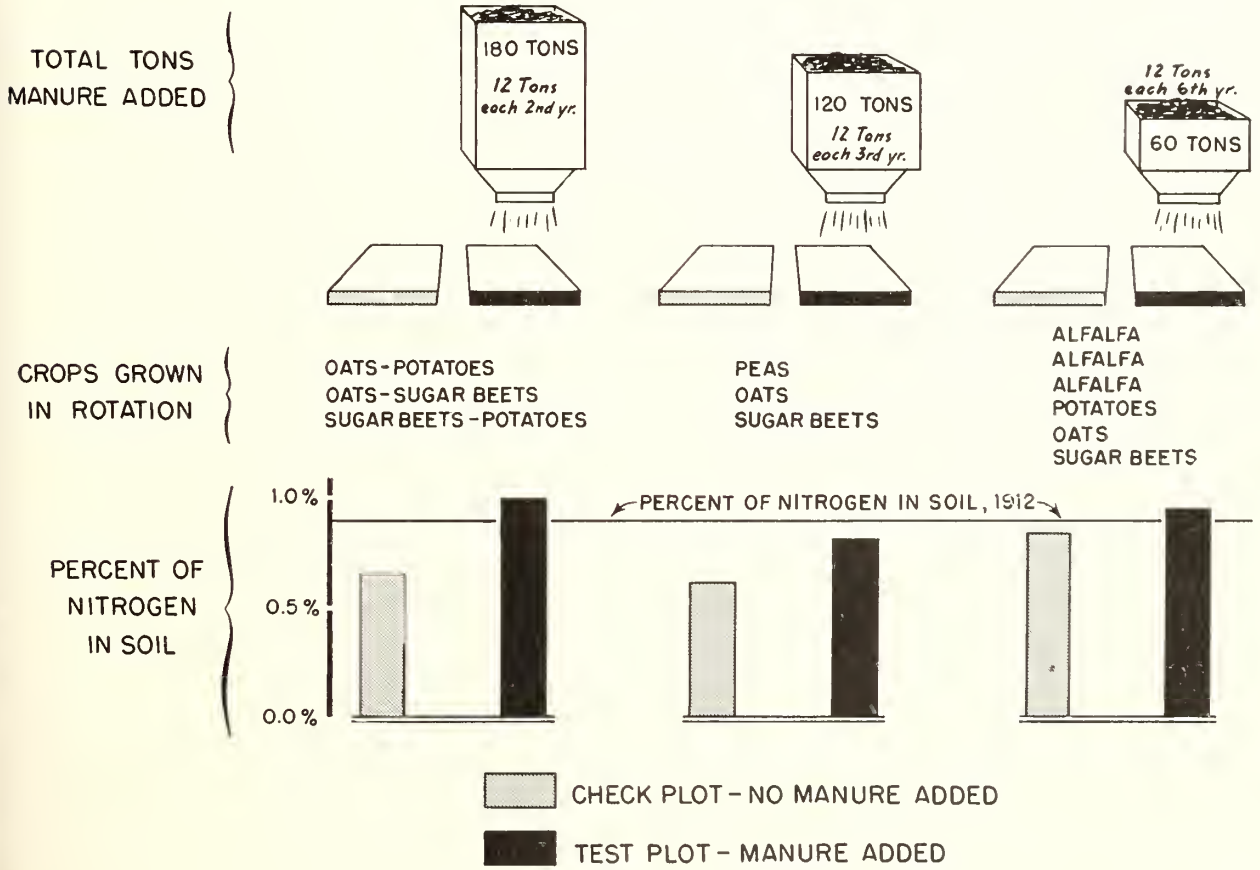
Part 1—Past and Present Trends in Nitrogen Use

by OMER J. KELLEY
Head, Division of Soil Management
Irrigated and Dry-Land Regions, United States Department of Agriculture

EDITOR'S NOTE: The following article represents a condensation of a paper presented at the annual banquet of the Western Soil Science Society at Corvallis, Oreg., on June 18, 1952.

NITROGEN FERTILIZERS ARE INCREASING CROP YIELDS all over the West. Research has shown conclusively that nitrogen is the most deficient plant food element in western soils. This applies to both irrigated and dryland soils. However, greatest response to nitrogen fertilizers occur under irrigation where moisture is not limiting. Present information leads us to believe that nitrogen fertilizers already are responsible for marked increases in crop production in the West. And, there is every reason to believe that we still haven't tapped the potential of crop production that nitrogen can help us attain.

What has been the trend in nitrogen fertilizer use in the past and where are we going in the future? First, let's look at the consumption of nitrogen in the 17 Western States in past years. This is shown in figure 1. You will note that consumption has increased considerably since 1945. And if we had presented figures for depression times, you would have seen quite an increase in 1945 over those of the thirties. What about the future? Most agriculturists are predicting that consumptive use will continue to go up, at least



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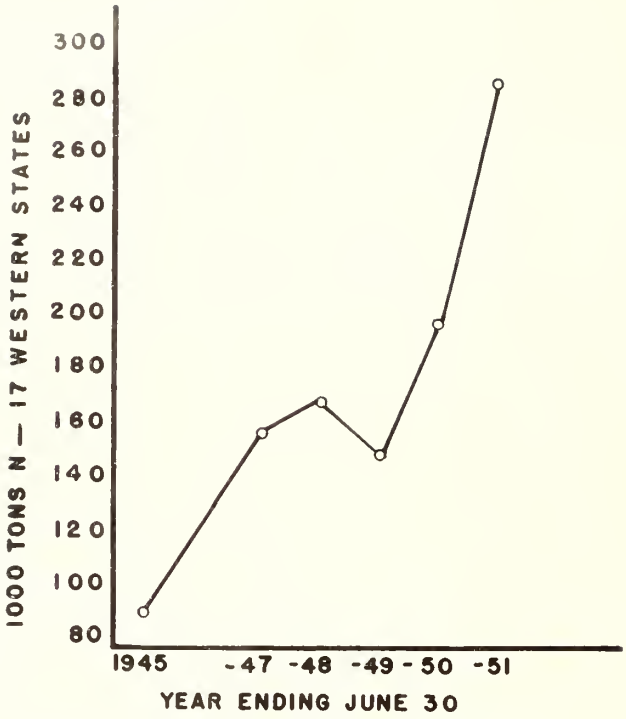


Increase in nitrogen consumption in 17 Western States.

for the next few years. And the expansion planned in the fertilizer industry assure us of plenty of nitrogen.

Soil Nitrogen Levels Are Declining

Nonlegume crops take a lot of nitrogen out of the soil. For example, a 60-bushel corn crop removes about 95 pounds of nitrogen per acre; a 30-bushel wheat crop removes 50 pounds, and a 15-ton sugar beet crop removes 115 pounds. This is replaced in part by growing legume crops and from barnyard manure. But there is usually quite a gap between removal and replacement, particularly on irrigated farms where numerous cash crops are grown.

Why do we need nitrogen fertilizers so badly on irrigated soils? The best way to answer this is to show what happened during 30 or 40 years on the same piece of land at Scottsbluff, Nebr. The illustration on page 73 shows how without either alfalfa or manure, the soil nitrogen decreased about 30 percent below that originally in the soil. Without alfalfa in the rotation, manure can maintain or slightly improve the nitrogen status—but it takes a lot of manure. As shown in the illustration, 12 tons applied every other year did the job; 12 tons every third year allowed the nitrogen status to decline. Even 3 years of alfalfa out of every 6 failed to maintain the nitrogen status unless manure was added. So it isn't easy to keep the nitrogen level of irrigated soils from declining. Very few farmers produce 6 tons of manure per acre per year, and not many keep their land in alfalfa half of the time.

The trends in these data are clear-cut and conclusive. Unless unusually large amounts of manure are used in conjunction with alfalfa in the rotation, we are going to lower the nitrogen content of our soil. And, in the West, there wasn't much nitrogen there in the first place. The average farmer using a couple of years of alfalfa in the rotation plus what little manure he can salvage just isn't going to do the job. Unless he applies nitrogen fertilizer his nonlegume crops are going to suffer from lack of nitrogen.

NEXT MONTH

HOW NITROGEN FERTILIZER INCREASES YIELDS

OR

NITROGEN AND YOUR DOLLAR

Trade and Reclamation

A 1 percent sample study of waybills conducted by the Interstate Commerce Commission in 1951 indicates that 1,544,300 cars weighing 39,820,200 tons were shipped into the 17 Western States from the 31 Eastern States and 2,210,400 cars weighing 71,927,900 tons were loaded in the 17 Western States for shipment to the 31 Eastern States.

Machinery, merchandise, and equipment weighing 525,000 tons were loaded into 29,200 freight cars and shipped to the 17 Western States from the New England States. The Middle Atlantic States dispatched 162,000 cars weighing 4,042,800 tons and the Industrial Great Lakes States an additional 608,000 cars weighing 13,353,000 tons to the 17 Western States area. The East South Central and the South Atlantic groups provided 99,200 and 84,700 cars weighing 1,058,800 and 1,134,500 tons, respectively, for the same area.

Significantly, the carloading and tonnage figures covered by Interstate Commerce Commission analyses include railroad shipments only and does not prorate the 162 billion ton-miles of shipments carried by motor trucks in the Nation during 1951.

PROFITABLE PASTURING by Hubert Peckham. In photo above, sheep keep ditchbank clean and will pay off well when they go to market. Below: "Upside-down fence." *All photos by Stanley Rasmussen, Region 1.*

DITCHBANK PASTURING AND ITS BENEFITS

by WILLIAM H. TULLER
Regional Supervisor of Operation and Maintenance
Boise, Idaho, Region 1

NO UNSIGHTLY WEED INFESTED FARM DITCH BANKS. NO EXPENSIVE MAINTENANCE PROBLEMS. PROFITABLE LUSH GREEN PASTURES ONLY. Those are the aims of Hubert G. Peckham. He and his son supervise farming operations on 560 acres of fertile irrigated land on the Wilder bench of the Boise project in Idaho.

Mr. Peckham, like many other progressive irrigation farmers, long ago discovered the unprofitableness and unsightliness of overgrown ditch banks. He believes irrigation district officials and the farmers should cooperate in controlling weeds on irrigation laterals.

Mr. Peckham's farm is a perfect example of using ditch banks profitably, and maintaining them in excellent condition with a minimum of effort and expense. Mr. Peckham markets a car-

Weed-infested lateral requires continuous cleaning.

Pastured lateral provides clean, well-preserved waterway.

load of lambs each year from his double fenced, ditch bank pasture. This is in addition to the pasture required for the ewes.

To make the maximum use of his fenced ditch banks, Mr. Peckham resorts to the unique practice of placing the woven wire "upside down" on the fence posts. In this case, "upside down" is "right side up." Peckham places the large mesh at the bottom of the fence. This permits the sheep to reach through and pasture on the other side. As they nibble away along the fence row, they neatly trim a 12- to 16-inch strip at the edge of the cropped field. This fence line pasturing becomes a multiple purpose operation. Weeds are kept under control. Weed seeds do not spread to the crops. Mowing, raking, and combining the crop is made much easier. Gone is the hazard of striking the fence or fence posts with farm implements. Crops which might otherwise be lost during harvesting are used in the production of mutton.

The sheep do very little damage to the sod ditch banks. On the contrary, their pasturing activity in the fenced-in area cuts down on several other maintenance chores. Weeds and grass which normally infest farm ditches are kept under control. Weeds do not spread over the farm. Water flows unobstructed in the ditch throughout the summer. No longer must supply ditches, as well as ditches which provide for the disposal of waste water, be cleaned once a year. A cleaning once in 4 or 5 years is sufficient.

Mr. Peckham points out that a good pasture is one of the best crops to grow from the standpoint of returns on the Boise project. That is why he is willing to use plenty of ditch bank space for this profitable venture. Generally speaking, he sets his fences 6 to 8 feet from the ditch bank. Along the head ditch this extra area allows for proper distribution of water before it reaches the cropped field. It also helps to collect runoff at the other end of the field.

Mr. Peckham believes the secret of maintaining good fences lies in initial construction. He estimates that his fences, which were erected in a very substantial manner, cost about $4 per rod. Corner posts are 10 feet long, and are driven 5 feet 4 inches into the ground. Fence posts, placed 12½ feet apart, are uniformly 4 feet 8 inches high. The woven wire fence is 47 inches in height with 6-inch stays. When occasion requires, Peckham strings one or two strands of barbed wire at the top of the woven wire.

Mr. Peckham takes pride in keeping his ditch banks clean, neat, and free from unsightly weeds.

"No weeds and lots of good pasture on ditch banks" is the way Mr. Peckham sums up his system.

# # #

HAVE YOU CHANGED YOUR ADDRESS LATELY? GOING TO MOVE SOON?

Let us know immediately so we can change our mailing list—it takes time, you know.

We'll do our best to deliver the RECLAMATION ERA to your correct address, but we have to know what it is.

SAFETY

on the Columbia Basin Project

by HAROLD E. WERSEN
Columbia River District Safety Engineer
Columbia River District, Ephrata, Wash., Region 1

"Kids are playing on the canal bank," the voice on the phone complained.

We received this call in the Columbia River District Office at Ephrata, Wash., one day last year, early in the irrigation season. The voice was that of the Bureau of Reclamation Watermaster stationed at Dry Falls Dam near Coulee City, Wash. It is here that the Main Canal of the Columbia Basin project takes off from the 27-mile storage reservoir that was formerly the ice-age channel of the Columbia River. The Watermaster's problem was at the taking-off point, where most of our safety worries in connection with the Nation's largest reclamation project begin—canal operation.

"They're rolling boulders into the water at the headworks. They're going to jam up a gate. If one of the boys slips, we're going to lose a boy," he continued.

The call was no sooner received than we were able to start a series of wheels moving, leading to corrective action that now is almost routine on this project.

We called civic leaders and school officials and arranged a series of canal safety meetings with the children in the schools and with the parents at P. T. A. in the evening.

Our information officer discussed the problem with the editor of the Coulee City News, Joe Pierce. The editor, already interested in canal safety, ran an editorial campaign accompanying the meetings. In the press or at our meetings, he never lectured. He merely stressed the urgency of the situation.

Almost immediately, the results came in. Our watermaster reported the youngsters had stopped throwing rocks into the canal works, and they had stopped playing along the dangerous rock cut, which in some places, at this point drops 90 feet in a jagged vertical chasm.

Action in this particular case could be taken quickly because of advance work which had been done long before the first water had been turned into the canals for testing. In each school district, at least three meetings had been held on the safety program.

Since then, local community groups have been formed at Coulee City and about a dozen other towns in this new project area. These can, and do, go into action on their own when a situation such as the one above arises.

Fishing is a case in point. If there's anything a boy on vacation loves, it's fishing. Our cool, green canal waters, pumped from the Columbia River, also pick up some nice fat bass on their long trip to the irrigable land.

Kids learned to loop their lines over the protecting wire fence into the canal. Soon that wasn't enough, however, and they went crawling down ladders inside the fence, to the water's edge. One of these locations was at the mouth to the Ephrata siphon. One overanxious lunge in landing a whopper, and there was slim chance that the youngster would get out alive.

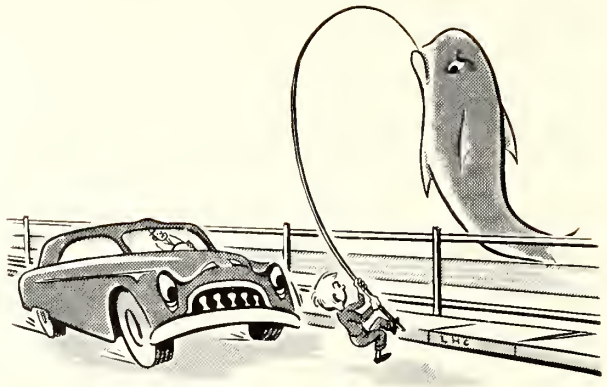
The local chief of police chased the boys out. The local editor, Jim Simpson of the Grant County Journal, aware of the safety campaign, called to tell us the boys were fishing in a dangerous area. We think we have the boys convinced it's safer from behind the fence. Next fall, we'll start more education campaigns in the schools.

Near Quincy, one youngster out fishing almost became a highway casualty—not a water victim. Fishing from the highway bridge, he became so excited in landing a big one, that he stepped backward into the path of an approaching car.

Children throughout the basin are very receptive to the canal safety meetings. They come in, shoving and shouting as all children do, but the minute the program starts, they are perfectly attentive.

The Columbia Basin project's safety and health problems are largely those of any new project, with one exception—there are larger canals and more of them. That is why community safety and health committees were organized.

When water first went into the canals for testing during the late summer and fall of 1951, most of the people of this area had never had any experience with large, treacherous, but innocent-appearing bodies of water.



When I mentioned this point at a community meeting in Quincy, a woman spoke up and said, "That's right. He knows what he's talking about. Most of you have never seen more water than you can get in your bathtubs. I've been on irrigation projects most of my life. They *are* dangerous!"

Health problems, such as garbage disposal and rodent control, manifested themselves as bureau residency camps pushed themselves into new construction areas adjacent to oldtime towns.

We embarked on an organized drive, in cooperation with the county sanitation and health offices in the counties involved, so that these problems could be solved by the people themselves.

Community safety and health groups are an established fact in such growing city centers as

Please turn to page 87

AUTHOR WERSEN (standing at head of room on right) in lower left photo attends safety conference of Bureau employees.

SIPHON MOVIE HOUSE. Crew of J. A. Terteling and Sons' canal workers view safety movie in Columbia Basin siphon, below right. *Both photos by Harold E. Foss, Region 1 photographer.*

Reducing the Risk in Reclamation Farming

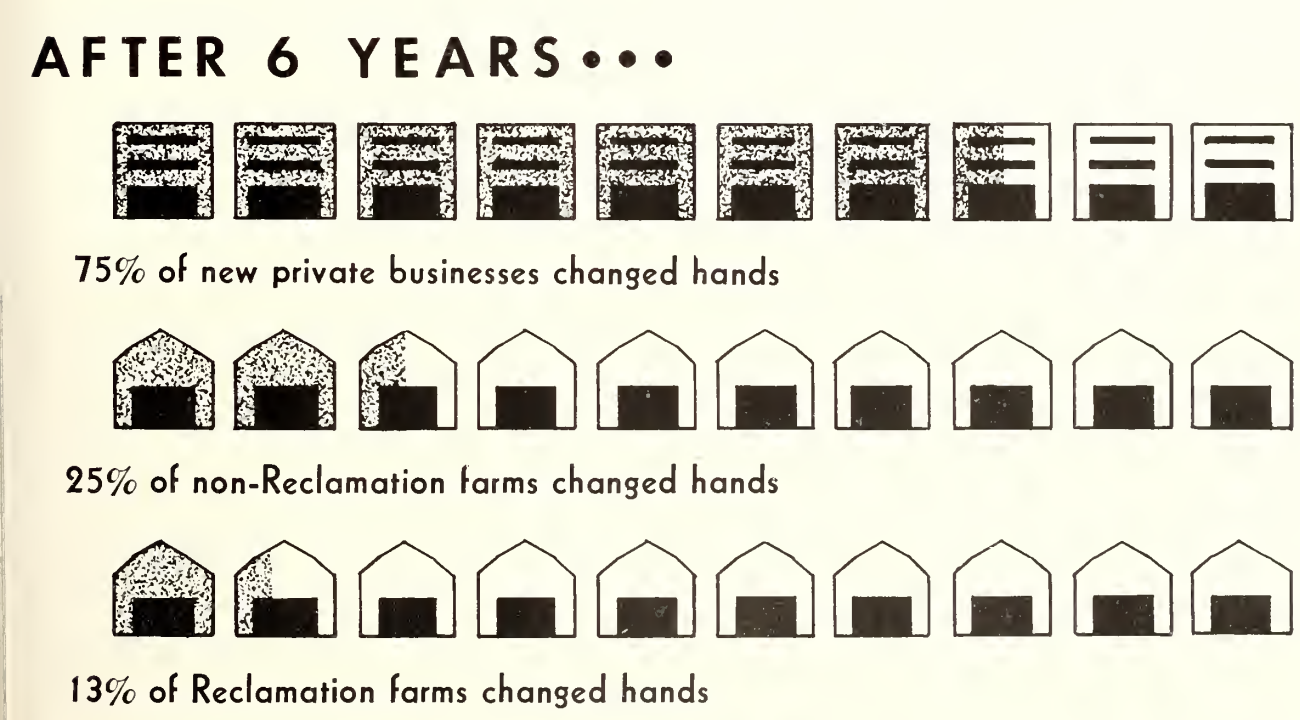
How have soldier-settlers fared on their Reclamation farms?

The Bureau of Reclamation recently made reconnaissance survey of the progress of new Reclamation farmers, mainly veterans of World War II. We found out that of the farms which were settled from 2 to 6 years, 87 percent or 751 of the units are held by the original owners. Only 112 (or 13 percent) have changed hands. On non-Reclamation farms in the Mountain and Pacific areas (where Reclamation projects are mainly located) approximately 250 farms or 25 percent would have changed hands in the same period according to the Bureau of Agricultural Economics. According to the Department of Commerce, during the same period less than 25 percent of all new private businesses are retained by the original operators. The remainder have been resold or liquidated.

Accordingly, it can be safely stated that these newcomers to Reclamation farming have made an excellent record, compared with non-Reclamation farmers and operators of small businesses.

Since December 1946, veterans have settled on 1,186 public land farms on Reclamation projects in the 17 Western States. The Tule Lake Division of the Klamath project in California and Oregon was the first area on which postwar farms were awarded. In this case 2,028 applications were received for the 86 farms awarded. Other land openings were held on the Gila and Yuma projects in Arizona; Boise and Minidoka projects in Idaho; Columbia Basin and Yakima projects in Washington; and the Riverton and Shoshone projects in Wyoming. The survey was based on the total of 863 farms rather than the overall total of 1,186 farms. The 863 have been settled for 2 years or more. The other 323 farms have been occupied less than 2 years, and are just getting under way.

On the 863 established farms, 128 of the settlers have been farming their original unit for 6 years. This represents 76 percent of the original 168 settlers. Only 40 of the new settlers of 6 years ago have left. During the entire 6-year period only 112 new settlers gave up their reclamation farms. Most of them, or 81 of the 112, sold their farms for a profit. Nine gave up because they found out they didn't have the necessary managerial or farming ability. Six had personal likes or dislikes which caused them to leave. Another six lost out because of financial difficulties. Four of the settlers got into "title trouble." Their entries



were contested. Four left reclamation farming because of death or sickness in the family. Only two relinquished their land because of what they considered its poor quality.

This record is far different from that of the early days of reclamation, when the rapid turnover of reclaimed farms gave credence to the statement, "It takes three generations of farmers to develop a new irrigated farm."

How were they able to make such a good record in such a short time?

One of the reasons might be found in the fact that these new entrymen to the Reclamation scene have to meet certain minimum requirements including at least 2 years of actual farming experience. They also must have a minimum amount of capital. The amount required varies from project to project but usually ranges from $3,000 to $5,000. This is only enough to barely get started and new settlers usually have to borrow considerable sums of money.

This is not the whole story, however.

The new crop of settlers has been working with a team of specialists from Federal, State, county, and local agencies who are interested in helping irrigation farmers make the most of their opportunities.

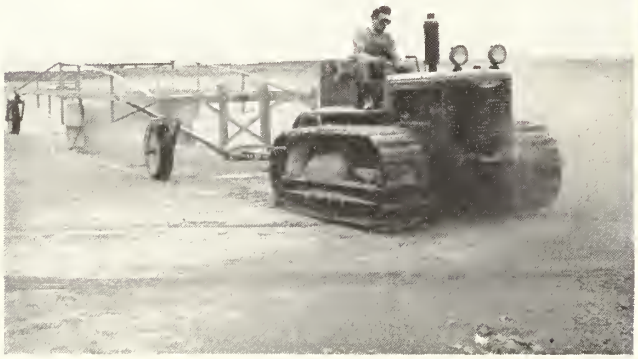
The State colleges, and several branches of the United States Department of Agriculture, have signed a total of 151 Memoranda of Agreement with the Bureau of Reclamation to help provide "know how" to these new farmers. Thus, today new settlers have the benefit of the experience gained during a half century of irrigation farming in the West. What's more, they are aware of the existence of this helpful information, seek it at every opportunity, and welcome the advice and assistance thus provided.

Development farms on many Bureau projects have been in operation for some time. They are designed to determine the best crops to grow in certain soils, to show which crops should be rotated and how often, and how to conserve and use irrigation water.

LOCATION MAP FOR POSTWAR FARMS FOR VETERANS

RAILROAD RAIL is used as drag to clear sagebrush by J. W. Davidson diate right Dee Harris, Assistant Agricultural Agent, handles the lev at Pasco. *Top photo by F. B. Pomeroy, right photo by H. E. Foss, both R*

LAND LEVELING by "Landplane" on J. F. D'Ewart's unit, Pasco area, Columbia Basin project.



THE WILLINGHAMS of Pasco getting the wash out with Junior's help. *Photos by H. E. Foss, Region 1.*

VETERAN SETTLERS Bruce G. Gillette and M. L. Marlowe (immediately below) dismantling WRA poultry building at Lingle, Wyo., for removal to Riverton, Wyo. Pete and Mrs. Milihov confer with carpenter on remodeling plans for their home at Shoshone Heart Mountain. Young Miss Milihov gets into the act. At bottom settlers Mr. and Mrs. Bovee, of Heart Mountain, irrigate a shelterbelt. Extension Service and Reclamation Bureau aided in establishing windbreaks.

bove at right. Imme-
ttler D'Ewart holds rod

How have the settlers put this advice into practice?

They have made remarkable progress in developing their land. Of the total 863 units, 50 percent of the settlers had developed more than 50 percent of their land at the end of the first year. At the end of the third year almost all of them had-three fourths or more than 75 percent of their land in production.

When it came to evaluating how well these farmers laid out their distribution systems, most of them were classed as "good." Those considered "excellent" outnumbered the ones classed as "poor." Actual construction of the distribution systems on the new farms was not considered as good as the layout. Many of the new settlers install temporary wooden structures in the beginning. As soon as their farm income permits, they plan to install permanent laterals, turn-outs, checks and other necessary structures in the irrigation system.

Land leveling has always been a headache for new settlers on irrigation farms. But they, most probably as a result of the settler assistance program, managed to level the majority of their farms to the point where they were considered "good" or "fair." There were more units classified as "excellently" leveled than received a "poor" rating.

Perhaps the biggest problem for any new farmer is housing. While he is getting his land

in shape, he must have a place to live. Most new settlers start out in makeshift shelters, some of which will later be used as farm buildings. Some settlers lived in tents for a short while until they were able to start work on more permanent homes. The Bureau of Reclamation was able to assist settlers in 13 of the land openings by providing them with World War II surplus barracks type buildings. Some of the newcomers used them "as is," while others used the lumber to build dwellings of a different type. Most of the settlers' homes were classed as either "good" or "fair." Almost a tenth were considered "excellent." About 18 percent of the residences were classified as "poor."

The average settler has net assets worth $19,000. The average varied from project to project and ranged from $5,000 to $45,000. On the average, each settler accumulated $3,240 additional capital each year. Accordingly settlers are able to purchase the required additional equipment and machinery for continued success on their irrigation farms.

Many of the settlers had automobiles, trucks, and tractors, as basic equipment when they moved to their units. At the time of the study electricity was available on 90 percent or more of the farm units. More than 30 percent of the settlers had telephones. Most of them now have wells from which they obtain their domestic water supply. In some localities settlers have cooperated in drilling a community well to provide themselves with domestic water. On projects where farmers have no domestic water supply, they haul their water, and store it in cisterns.

In most instances, the initial cash requirements were not enough. Most of the settlers have had to borrow additional money to develop their farms, build homes, obtain machinery, or to meet other expenses necessary to irrigation farming. Their major source of credit is the Farmers Home Administration. Others include commercial banks and loan companies, supply dealers and businessmen in general. The amount of money borrowed by these new settlers ranged from $300 to $27,000.

The Bureau's survey indicates that the settlers are making rapid progress. The quality of the land development is satisfactory. Their standard of living is fair to good, judged by the quality of housing, equipment, and capital accumulation. Reclamation farming appears to be a good sound American business venture. Cooperation is taking the risk out of Reclamation farming.

# # #

HOME WAS A TENT for E. C. Mosebar of Pasco while permanent residence was being built. *Photo by H. E. Foss, Region 1.*

IN CLOVER—Finest clover in the world from the North Unit of the Deschutes project in Oregon being examined, below. George Rodman of the North Unit, at left. *Photos by Stanley Rasmussen, Region 1.*

MORE BLUE RIBBONS FOR DESCHUTES SEEDS

by CARLOS C. RANDOLPH, Irrigation Manager,
North Unit, Deschutes project, Oreg., Region 1

The North Unit of the Deschutes project in central Oregon still tops the world when it comes to producing Ladino Clover seed.

If that claim appears too broad, the results of the judging at the Royal Agricultural Winter Fair at Toronto, Canada, are a pretty good convincer.

Seed Growers of Jefferson County, Oreg., won more than $300 in prize money from their alfalfa, ladino, red and alsike clover seed exhibited at the Fair November 14 through 22, 1952.

Out of the 41 white clover entries, which included ladino, 26 of the prize winning entries were from the United States, and all these were from the North Unit of the Deschutes project.

In other words, out of 31 awards, North Unit farmers won all but the ninth, tenth, eighteenth, twenty-sixth, and twenty-ninth prizes. In the alfalfa seed division, one entry from the North Unit placed tenth. In the red clover division, North Unit growers garnered, eighth, ninth, and twenty-sixth places. In the alsike division which is Canada's long suit, North Unit growers again took fourth, fifth, and sixth places.

The Royal Canadian Agricultural Winter Fair is an annual event. Seed, grain, and hay entries are received from agricultural centers in Canada, the United States, and Europe. Winners in each class are recognized as world champions. North Unit project entries have consistently won top awards at the Toronto Fair, but not always in the volume shown this year.

The collection and shipment of each 10-pound entry was sponsored by the Jefferson Seed Growers Association, one of the most active grower organizations in the North Unit, Deschutes project, Madras, Oreg.

Officials of the seed, grain, and hay division of the Royal Canadian Fair toured the North Unit region in September of 1952 to observe first hand the techniques employed by project

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A Well-kept Lateral Gathers No Moss

PART 2—CAUTIONS AND COSTS ON CONTROLLING WATERWEEDS IN IRRIGATION LATERALS

by JESSE M. HODGSON, Assistant Agronomist
Division of Weed Investigations
University of Idaho

EDITOR'S NOTE: The following article was prepared on the basis of the cooperative investigations of the Division of Weed Investigations, Bureau of Plant Industry, Soils and Agricultural Engineering, Department of Agriculture, and University of Idaho and was adapted from information contained in Idaho Extension Circular No. 123.

TREAT WATERWEEDS WHEN THEY HAVE BEGUN TO GROW vigorously and are causing a noticeable rise in the water level. Do not wait until they have reached the surface of the water. Younger plants are easier to control, and you can reduce the flow of water most conveniently at that time.

Second treatments may be necessary in 5 to 8 weeks after the first. Since aromatic solvents kill the weeds through contact with the foliage, roots and bulbs may not be damaged. During long hot summers, in the Northwest there may be enough regrowth to warrant a second treatment. In the Southwest three to five treatments may be needed. To do a good job you must have the correct timing, the correct amount of chemical for the amount of water in the ditch, and make certain the solvent is thoroughly emulsified with the water.

Temperature of the water has much to do with the growth of the waterweeds. When water is warm, the weeds grow much faster than when the water is cold.

Tests have shown that treatments in fairly clear, clean water are more effective than in water carrying a heavy load of silt or soluble salts.

Waterweeds show a darkened appearance and the plants lose their rigidity in the water soon after they are treated with aromatic solvents. The plants become limp and are forced downward by the water flowing over them. This reduces the congestion in the ditch, and the water usually flows at near normal rates within 24 hours after treatment. The dead plants turn brown and may lie on the bottom of the ditch for 10 to 20 days before the force of the current gradually removes them. Dead weeds did not become a problem in ditches or irrigation furrows in any of our tests.

Aromatic solvent waterweed treatments do not harm some crop plants. Even higher concentrations of the solvents than those used in any of the waterweed control trials did not damage field and garden crops tested. Solvents were applied by row irrigation to potatoes, beans, sweet corn, sugar beets, and carrots. Oats and wheat were treated by flood irrigation. Although sugar beets and wheat showed some reduction of yield from excessively high concentrations of aromatic solvent, there was no damage or yield reduction of these or any of the other listed crops from concentrations higher than those used for waterweed control. Other crops that have not been tested may be damaged by aromatic solvent in irrigation water. Because we are still unsure of its effect on these untested crops, we advise wasting the treated water rather than risking crop injury by using it on those crops that have not been tested.

Aromatic solvents are distasteful to livestock so that usually they will not drink treated water. The quantity of solvent in water treated for waterweed control is relatively small. Six gallons of solvent applied to 1 cubic foot per second of water for 30 minutes is equivalent to 1 gallon of solvent to 2,250 gallons of water. Because of this, it is unlikely that livestock would be injured from drinking the treated water. However, it would

be safest to keep thirsty animals away from water containing the solvents.

Fish and other marine life are killed by contact with the solvent. However, as aromatic solvent is lighter than water, the material evaporates a few hours after application, thereafter losing its effectiveness.

Aromatic solvents are inflammable and must be handled with the same caution required in handling gasoline. Do not breathe fumes of the solvents or let the concentrated materials come in contact with your skin for prolonged periods. Do not use around an open flame. Take every reasonable precaution.

The cost of treating irrigation ditches and laterals with aromatic solvents depends on the amount of solvents used, and labor and equipment costs. The retail price of these commercial waterweed killers in Idaho has varied from 65 cents to $1 per gallon. Enough solvent to treat 1 cubic foot per second of water for a 1-mile-long ditch costs $3.90 to $6. Labor and equipment would be a smaller item, probably not more than $2.50 per hour, or per 30-minute treatment, including time to set up the equipment.

Although some waterweed killers cost more and specifications vary, the higher priced products have not necessarily given better results than those sold for less.

Aromatic solvents from different sources and different refining processes vary in composition. Always buy commercial waterweed killers from reputable dealers. Some test failures were traced to faulty materials that did not meet the specifications for waterweed-killer solvents.

EDITOR'S NOTE: Parts 8 and 9 of the "Short Cuts to Weed-Killing Calculations" which appeared in the RECLAMATION ERA are also available in reprint form. Your nearest regional director has a limited supply for free distribution. Additional material may be obtained in the two articles appearing in the April and May 1950 issues of the RECLAMATION ERA, entitled "Aromatic Solvents for Waterweeds," by V. F. Bruns and W. H. Farmer.

Have you a good idea on a short cut or labor-saving device to share with other water users on Reclamation projects? Send it in to your nearest Bureau of Reclamation office or to the Editor, RECLAMATION ERA, Bureau of Reclamation, Washington 25, D. C. The writing does not have to be fancy. Just make certain you have the answers to Who, What, Where, When, Why, and How in your story. As for pictures, a rough sketch or snapshot would serve our purposes. Remember, this is the only official publication of the Bureau of Reclamation, the only periodical devoted entirely to the interests of water users on projects served with facilities made available by the Bureau. It is your magazine, and will be as good as you can make it. By helping others you will also help yourself. Send your item in today.

AUTHOR APPLYING AROMATIC SOLVENTS to test plots on weed station of B. P. I. in Boise Valley to determine effects on crop plants. *Photos by Stan Rasmussen, Region 1.*

FOUR STATES IRRIGATION COUNCIL ORGANIZED TO CUT COSTS

by L. I. HEWES, Jr., Chief, Land Use and Settlement,
Region 7 Headquarters, Denver, Colo.

Irrigators of Colorado, Wyoming, Kansas, and Nebraska have taken a major stride towards implementing a common assault on the problems of rising costs of operation and maintenance on hydraulic systems through formation of a Four-States Irrigation Council.

The Council came into being as an experiment late in 1951. About half a hundred irrigators from the four-State region got together in Denver to figure out a way they might present a united front against the bugaboo of steadily mounting costs of doing business.

The first meeting of the Council held in 1952 proved so successful that key persons attending assumed the responsibility for continuing the activity and solidifying its form. This led to the Council's second annual meeting held January 14 and 15, 1953, on the campus of Colorado A. & M. College at Fort Collins, Colo.

The second meeting was well described by E. O. Daggett, first president of the Council, when he said the gathering brought together "directors, superintendents, water masters, assistants, engineers, managers, and others who are responsible for the successful operation and maintenance of irrigation and power projects."

There were 120 persons in attendance at this year's meeting of the Council. Bylaws under which future operations of the Council will be carried on were set up and unanimously enacted. A strong slate of officers was installed.

The Council has set for its goal providing the means for irrigators to exchange ideas and information, to state problems in open meetings, and learn if solutions to those problems have perhaps been found by others present.

The bylaws enacted at this year's meeting clearly established the goals in this language: "Membership is extended to each irrigation and hydroelectric project within the State of Nebraska, State of Wyoming, State of Colorado, and State of Kansas . . ." Purpose is set forth as "to provide an opportunity for its members to cooperate in the study of the problems pertaining to the operation and maintenance of hydraulic systems; to exchange experience and render aid to the members in solving the problems in operating and maintaining such systems."

To direct the Council's work, a president, vice president, and secretary-treasurer were elected, plus five directors, one from each of the four States represented in membership and a director-at-large chosen from the Bureau of Reclamation.

Federal and State agencies concerned with irrigation and power developments also are included in participation in the Council's activities in order that cooperative achievement may be realized.

While the objectives of the Council sound lofty, its approach to the subject is of grassroots practicality, as shown by the items included in the program.

Keynote for the meeting was sounded by Avery A. Batson, Director of Region 7 of the Bureau of Reclamation, who discussed "What Is New" in irrigation and power fields.

Most of the balance of the program was devoted to panel discussions followed by question and answer discussion periods.

Topics dealt with included flood control, weed control, seepage control, labor and equipment, and distribution of irrigation water. Practical experts on each of the subjects covered preassigned subtopics under each of these general headings, following which general "bull sessions" developed active audience participation.

Many of the speakers employed motion pictures and slides to illustrate graphically their presentations. Slides were used to demonstrate various practical techniques, such as weed control methods and equipment for doing the best job; how to properly and also improperly apply water to the land; what the ravages of flood waters are when torrents are loosed upon irrigation works and irrigated lands, and methods and items of equipment which are producing money-saving and efficiency-increasing results.

Plans for the next annual meeting will be drawn by the officers and board of directors with

the latter determining where the meeting shall be held. Many of the delegates voiced a desire to have future meetings held in Denver because of its accessibility and so that other business can be transacted while delegates to the Council's sessions are in the city.

Officers elected for the ensuing year were: James L. Doyle, superintendent of the Windsor Reservoir & Canal Co., Fort Collins, Colo., president; Perry Sweat, a director of Kirwin Irrigation District No. 1, in Kansas, vice president; Breck Moran, director of the State of Wyoming's resources development department, secretary-treasurer. Directors include Kyle F. Bryning, superintendent of the Rio Grande Canal Association at Monte Vista, Colo., representing Colorado; Galen Lowry, vice president of the Gering-Fort Laramie Irrigation District, representing Nebraska; A. E. Olson, vice president of the Goshen Irrigation district, representing Wyoming. The Kansas directorship remained to be filled because Sweat was at first elected to represent that State on the board and was later elected vice president of the Council. It was agreed that no officer should hold two posts concurrently and plans were being made to name a replacement for Mr. Sweat on the board. # # #

Safety on the Columbia Project

Continued from page 78

Burke, Coulee City, Coulee Dam, Eltopia, Ephrata, Mesa, Moses Lake, Othello, Quincy, Soap Lake, Warden, and Winchester.

P. T. A. groups, the American Legion, business clubs, 4–H Clubs, chambers of commerce, grade and high schools have formed the nucleus of the community groups.

Their problems are canal safety, farm home safety, traffic safety, school safety, and fire safety.

Under the preventative health education program, committees will handle rodent and mosquito control, garbage disposal, sanitary fills, sewage, and water pollution (which includes domestic water as well as water for recreational purposes).

First-aid classes are carried on by the Safety Division throughout the year and are available to anyone within the community, where the classes are scheduled.

Bureau personnel will act as advisors and furnish information for these groups in putting on their educational programs, but we will not go out to take care of their problems.

In addition to the community safety and health program, we hold periodic safety and health conferences for all of our employees, as well as contractors' employees, so that everyone in the basin will be aware of the problems and hazards involved.

Our sole purpose is to provide answers to the questions of how and why we can eliminate hazards to both safety and health. Some of our canal signs say "Stay alive by staying out." Communities also show they are alive by "staying in"—by developing the district safety and health program. # # #

NEXT MONTH
WEST-WIDE WATER REPORT

Time to Renew?

You'll find the expiration date of your subscription on the address stamped on the back of your copy of the RECLAMATION ERA. If the number at the left-hand side of the address, directly beneath the number and street reads "6–53," for example, the last issue under your subscription will be the 6th month—June—of the year 1953.

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More Blue Ribbons For Deschutes Seeds

Continued from page 78

seed growers in the production of high quality seed crops.

In 1952, about 22,500 acres of the 50,000-acre Deschutes project were devoted to the production of seed crops as compared to 27,000 acres in 1951. People around Deschutes believe the acreage devoted to seed growing will continue to decrease gradually, due to the normal change to more diversified farming, and also the difficulty in maintaining weed-free crops which is essential to high quality certified seed growing. #

NOTES FOR CONTRACTORS

Contracts Awarded During February 1953

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DS-3812	Palisades, Idaho	Feb. 24	4 35,000-kilovolt-ampere transformers for Palisades power plant.	Pennsylvania Transformer Co., Canonsburg, Pa.	$410,023
DS-3838	Central Valey, Calif.	Feb. 25	6 10-foot 10-inch by 12-foot 6-inch bulkhead gates, 1 lifting frame, and 1 lot of seats, guides, and latches for turbine draft tubes at Nimbus power plant.	Schmitt Steel Co., Inc., Portland, Oreg.	22,778
DS-3839	Palisades, Idaho	Feb. 4	Steel penstock manifold and outlet pipe manifold for Palisades dam and power plant.	American Pipe & Construction Co., Portland, Oreg.	1,098,600
DS-3850	Missouri River Basin, S. Dak.	Feb. 5	1 10,000-kilovolt-ampere synchronous condenser with starting antotransformer and control equipment for Rapid City substation.	General Electric Co., Denver, Colo.	145,832
DC-3858	do	Feb. 4	Construction of Fort Randall tap-Fort Randall 115-kilovolt-ampere parallel transmission lines, each 11 miles long; and Fort Randall-O'Neil and Fort Randall-Winner 115-kilovolt-ampere parallel transmission line extensions, each 1.7 miles long.	Malcolm W. Larson Contracting Co., Denver, Colo.	220,459
DS-3859	do	Feb. 27	14 Disconnecting switches and 2 horn-gap switches for Folsom and Nimbus switchyards, schedules 1, 3, and 4.	Schwager-Wood Corp., Portland, Oreg.	61,093
DC-3861	Missouri River Basin, Kans.	Feb. 5	Construction of earthwork, structures, and track relocation of Missouri Pacific R. R. at Kirwin Dam.	Cook Construction Co., Jackson, Miss.	966,150
DC-3865	Central Valley, Calif.	Feb. 6	Construction of earthwork and structures for lateral 32.2 and sublaterals, north section, pt. 1 of unit 3, Madera distribution system.	Stolte, Inc. & Pacific Contracting Corp., Oakland, Calif.	444,139
600C-109	Missouri River Basin, Wyo.	Feb. 13	North Cody Substation and overhead ground wires for approach spans.	Long Construction Co., Billings, Mont.	33,505
617C-31	Riverton, Wyo.	Feb. 9	Stockpiling and placing gravel for asphaltic membrane lining cover, Station 1247/00 to 1490/00, Wyoming Canal.	Raecke and Scott, Lander, Wyo.	13,320
701C-299	Missouri River Basin, Kans.	Feb. 24	Construction camp at Webster Dam	Trowbridge-Oebring Construction Co., Columbus, Nebr.	63,083

Construction and Materials for Which Bids Will Be Requested by June 1953

Project	Description of work or material
Boise, Idaho	Relocation and construction of community facilities at Arrowrock Dam near Boise, Idaho.
Colorado-Big Thompson, Colo.	Construction of small timber bridge and barbed-wire fencing at Willow Creek feeder canal, 4 miles northeast of Granby, Colo.
Columbia Basin, Wash	Construction of a 24-mile unlined reach of West canal, 500 to 100 cubic feet per second capacity, and Goose Lake wasteway for the canal's fifth section, 8 miles north of Corfu, Wash., is to include bifurcation structure, 3 county road bridges, 22 check structures, and 77 turnout structures.
Do	Construction of 34 miles of unlined area W-6B laterals, sublaterals, and wasteways having base width of 2 to 14 feet, varying from 90 to 2 cubic feet per second capacities on West canal near Quincy, Wash. Work also includes the construction of concrete structures, including division boxes, checks, weirs, culverts, and drops, and 2 pumping plants, 1 48 cubic feet per second and 1 41 cubic feet per second capacity.
Do	Construction of 13 miles of unlined drains in lateral areas E-2 and E-3, varying from 40 to 5 cubic feet per second capacities on East Low canal, near Moses Lake, Wash.
Do	Installation of supervisory control and telemetering equipment for the bifurcation works and Adco watermaster's office near Ephrata, Wash., will include construction of 4 small buildings and 0.5 mile of 2-wire line to serve as master control circuit.
Do	Installation of lighting standards, luminaires, and power and control circuits at entrances to powerhouses, along South Marina Way, and in Coulee Dam, Wash.
Do	Planting native grass on slopes in vicinity of Grand Coulee dam and switchyards, and landscaping at powerhouses, pumping plant, and switchyards.
Do	Furnishing and installing steel and aluminum handrailing and curbings for Grand Coulee pumping plant and bus runway, and right and left power plants at Coulee Dam, Wash.
Do	Installation of cooling equipment in Ephrata office building is to include furnishing and installing a 75-ton compressor, direct expansion coil, and associated equipment.
Davis Dam, Ariz.-Nev.	Interior painting of all metal work, structures, and equipment in Davis Dam, power plant, and switchyard.
Eden, Wyo.	Construction of Prospect diversion dam and canal near Farson, Wyo., will require 225 feet of earth dike, a rock weir 4 feet high and 70 feet long, and 2 miles of 75 cubic feet per second Prospect canal, including 2 concrete drop structures and a precast siphon. Contractor will also construct 0.4 mile of 5 cubic feet per second farm lateral, 2 precast siphons, and 1 farm bridge, and raise 2 other bridges.
Gila, Ariz.	Construction of 22 miles of unreinforced concrete-lined laterals and sublaterals of 45 to 15 cubic feet per second capacities for unit 4 of Mohawk distribution system near Wellton, Ariz. Concrete structures include turn-outs, checks, drops, siphons, culverts, and lateral turn-outs. About 170,000 cubic yards of excavation for laterals is required.
Do	Construction of 2.4 miles of 220 cubic feet per second Dome canal and 2.6 miles of 100 cubic feet per second lateral D-1.4E, near Dome, Ariz. Structures on Dome canal will include river siphon, road siphon, radial gate check, 3 bridges, 2 constant-head orifice turnouts with capacities of 100 and 60 cubic feet per second, and 8 slope-type turnouts of 15 cubic feet per second capacities. The open distribution system will serve about 12,000 acres. Structures on lateral D-1.4E consist of 2 bridges and a pump lift.
Kendrick, Wyo.	1 oil purifier, both centrifuge- and filter-press-type, of 600 gallons per hour capacity, and 1 filter paper drying oven for Alcova power plant.
Middle Rio Grande, N. Mex.	Construction of 22 miles of access roads to channelization work on the Rio Grande, and placing about 3 miles of gravel protection on levees, near San Marcial, N. Mex.
Missouri River Basin, Mont.	Missouri diversion dam to be constructed across the Missouri River near Wolf Point, Mont., is to comprise about 2 miles of earth dike and a gated concrete overflow section. Construction of Little Porcupine power plant which is to have a reinforced concrete substructure and a steel superstructure.
Do	Construction of basement for a house, placing foundations for a shop-garage, and moving and placing house and shop-garage on their foundations, including installation of necessary utilities, near Toston, Mont.
Missouri River Basin, Nebr.	Construction of 18 miles of unlined Cambridge canal's fourth section, including drains and channel changes with appurtenant reinforced concrete structures. Canal ranges in capacity from 125 to 30 cubic feet per second.

Construction and Materials for Which Bids Will Be Requested by June 1953—Con.

Project	Description of work or material
Missouri River Basin, Nebr.—Continued	Construction of 7 miles of unlined laterals varying from 12 to 6 cubic feet per second capacities, with appurtenant reinforced concrete structures for the second section of Cambridge canal near Oxford, Nebr., 32,000 cubic yards of lateral excavation.
Missouri River Basin, Nebr.-Kans.	Construction of 18 miles of unlined laterals varying from 12 to 6 cubic feet per second capacities, with appurtenant reinforced concrete structures for Frauklin canal's first section, near Franklin, Nebr., 90,000 cubic yards of excavation.
Do	Construction of 11 miles of unlined Naponee canal, laterals, and drains varying from 36 to 6 cubic feet per second capacities, with appurtenant reinforced concrete structures, 12 miles west of Franklin, Nebr., on the south side of the Republican River beginning at Harlan County Dam. 200,000 cubic yards of excavation and about 8,000 feet of 18- to 28-inch diameter concrete pipe.
Missouri River Basin, Wyo.	Construction of 1,000-kva Meeteetse substation near Meeteetse, Wyo.
Palisades, Idaho	The Snake River bridge is to be a 3-span continuous deck plate girder bridge for Wyoming State Highway, U. S. 89, near the Idaho-Wyoming boundary. The end spans are 136 feet center to center of bearings and the center span 264 feet.
Do	12 turbine draft-tube bulkhead gates, lifting beam, seats, guides, and latches for Palisades power plant.
Rio Grande, N. Mex	Construction of wasteway channels includes excavating and enlarging about 3 miles of wasteway channels on Picacho Arroyo system and construction of 3 concrete check-wash-drop structures and Picacho lateral check siphon, near Las Cruces, N. Mex.
Do	Furnishing material and stringing 2 galvanized steel overhead ground wires on 360 miles of existing 115-kilovolt transmission lines, and furnishing and stringing 3 397,500-centimeter ACSR conductors on 2 miles of line, all in New Mexico.
Shoshone, Wyo	Clearing and leveling about 500 acres of land at the old Heart Mountain camp site.
Yakima, Wash	The combined Chandler power and pumping plant structure to be constructed on the Yakima River, about 9 miles downstream from Prosser, Wash., will consist of a 12,000-kilowatt power plant to house 2 6,315-kilovolt-ampere generators, and a 500 cubic feet per second turbine-driven pumping plant to house an initial 2 and an ultimate 3 167 cubic feet per second units. The substructure and intermediate structure will be reinforced concrete and will have dimensions of 49 by 171 by 31 feet; the contractor-furnished superstructure to measure 39 by 140 by 38 feet will be of steel framing with insulated metal wall panels. The headworks consists of a gated iceway 20 by 3 feet; four siphon spillways discharging into a 1,500 cubic feet per second, 390-foot-long spillway chute; a 4-foot diameter sluice gate; a trash-rack structure at entrance to 2 120-inch power penstocks; and 3 87-inch pump supply lines. The contractor will construct a 3,500-foot-long, 99-inch-diameter, 250-foot head pump discharge line across the Yakima River to the Main canal; and furnish steel pipe or concrete pipe steel lined for 2,300 feet. He will install embedded parts of 2 85,000-horsepower and 2 2,600-horsepower government furnished turbines and a 40-ton bridge crane; and construct a railroad bridge and highway bridge.
Do	2 oil pressure, cabinet-type, gate shaft governors for regulating the speed of 2 8,500-horsepower hydraulic turbines for Chandler power plant.

United States Department of the Interior, Douglas McKay, Secretary

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Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

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Water is Wealth

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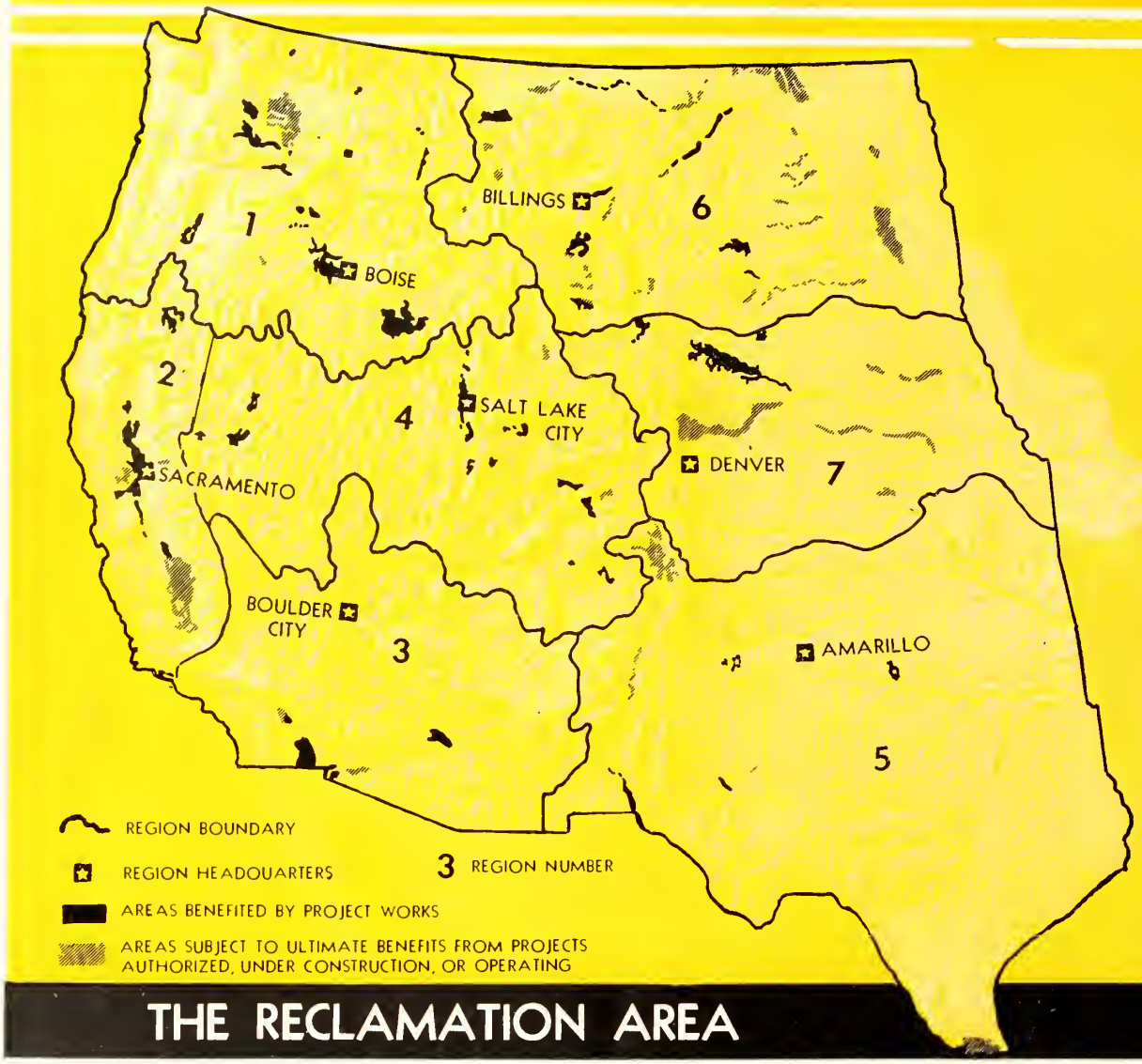

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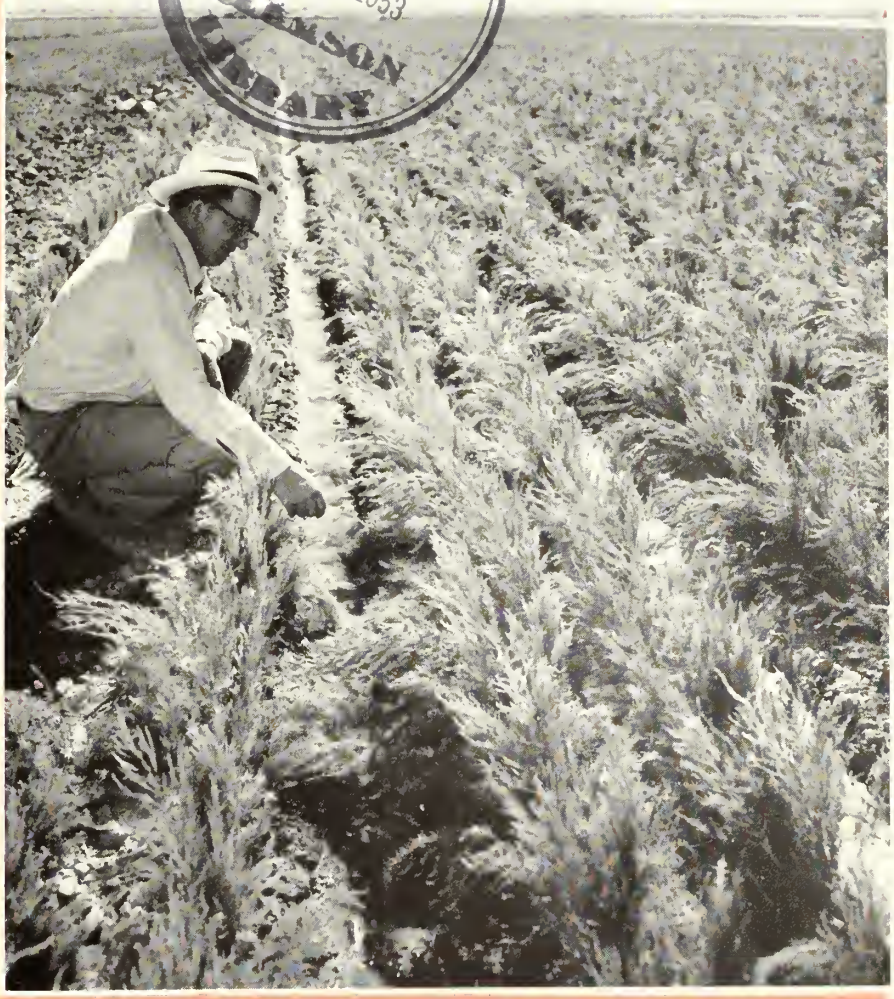

May
1953

IN THIS ISSUE:

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Volume 39, No. 5

The Reclamation ERA

35 Years Ago In The Era

Making the Farm Pay

In making the farm pay the first essential is to have a farm which may be developed and put into condition to make it a profitable proposition. The successful farmer is the one who dominates the situation and manages his business along well-defined lines instead of permitting his business to proceed along haphazard lines. In irrigation farming the farmer controls all the essential factors of successful farming.

The first thing for a farmer to do is to plan a system of farming or what is commonly termed a crop rotation. Crop rotation is the means of good crops, it is the means of maintaining the fertility of the soil, and an even and economical distribution of the farm labor. A good rotation of crops will eradicate weed pests and minimize the danger of insect pests and crop sickness.

Plan your crops 3, 5, or 10 years in advance. Don't plan with the single idea of getting ahead of your neighbor; plan to improve your own condition.

Real business is not to get ahead of others; it is to get ahead of yourself.

(Excerpts from an article by I. D. O'Donnell, on page 203 of the May 1918 issue of the Reclamation Record, predecessor to the Reclamation Era.)

OUR FRONT COVER—INSPECTING ASPARAGUS SEED STOCK raised by Ray Young from seed, near Quincy, is John L. Toevs, Chief of Land Development Branch on the Columbia Basin project in Washington State. The 4 acres of seed stock were transplanted over 70 acres this spring. *Photo by F. B. Pomeroy, Region 1.*

OUR BACK COVER is based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners Kittredge and Coolidge.

DESIGN AND ILLUSTRATIONS by Graphics Section, Bureau of Reclamation, Washington, D. C.

J. J. McCarthy, Acting Editor

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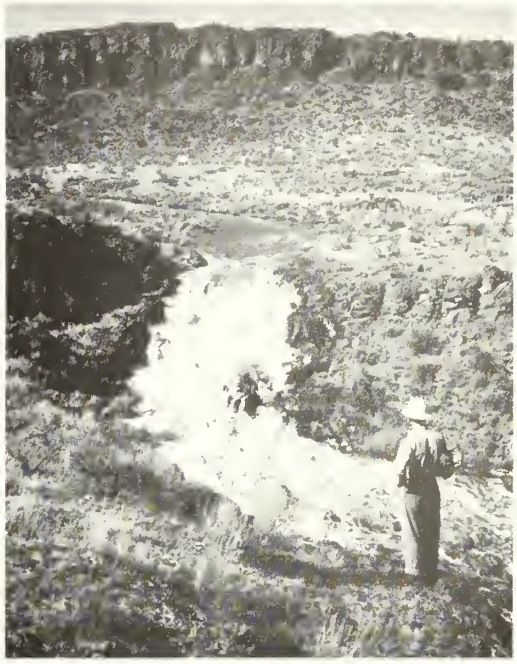
In this issue . . .

RECLAMATION PLACE NAMES IN THIS ISSUE



PETRIFIED WOOD examined by Dr. J Harlen Bretz, left, and Reclamation geologist W. E. Walcott. At right, "New Water," flows down a channel part of Potholes East Canal. The view is called Soda Lake. Photos by H. E. Foss, Region 1.

"SCABLANDS" IN THE COLUMBIA BASIN

by RAY J. SCHRICK
Columbia Basin Project
Ephrata, Washington, Region 1

DR. J HARLEN BRETZ, professor emeritus of geology at the University of Chicago and one of the world's foremost geologists, recently returned to the Columbia Basin for approximately 3 weeks to resume field work on his theory of the origin of the scablands in central Washington.

One reason for Dr. Bretz' return after an absence of more than 2 decades, was the uncovering of new geologic evidence in the digging of canals, tunnels, and borrow pits in the course of building the Bureau of Reclamation's Columbia Basin project.

He declared after his initial 5 days in the field, that the new evidence he had seen "proved conclusively" the truth of statements he first conceived almost 30 years ago, when the irrigation dream in the Columbia Basin was only an embryonic idea.

Dr. Bretz started his field work in the basin in 1922, the same year that Maj. Gen. George W. Goethals, builder of the Panama Canal, was brought in to investigate means of irrigating the basin territory.

Dr. Bretz left the basin after 7 years of field work in 1929, and his last published work, a book entitled "The Grand Coulee," appeared in 1932.

His theory is that an enormous flood, perhaps the largest in the world, made the scablands of eastern Washington in a period of perhaps a few days. The theory has been a source of argument in geologic circles for the past 2 decades.

Glacial waters were dammed 2,200 feet deep in glacial Lake Missoula, part of which is now Pend Oreille Lake, according to the geoligist. The noted Cordilleran Ice sheet, lying between the Rockies and Cascades in Canada dammed the giant waterway near the head of what is today the Clark Fork River.

The glacial Lake, according to Dr. Bretz, contained about 500 cubic miles of water at its maximum, and its surface level then was 4,200 feet above sea level.

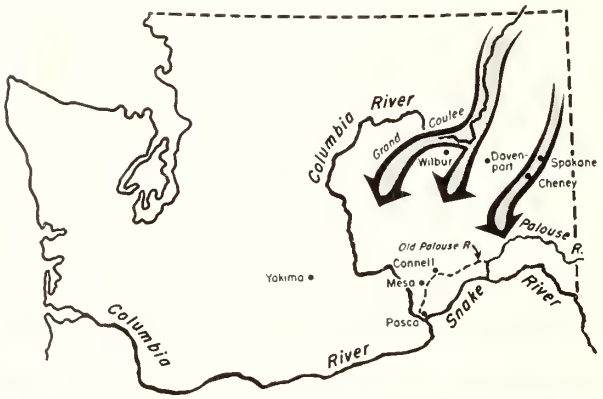
By far the greater quantity of this water was released suddenly, and in the crashing of the flood, an area almost twice as large as the state of Delaware was washed virtually clean of productive soil, leaving only the barren rock.

This volume of water would be sufficient to cover the state of Texas to a depth in excess of 5 feet.

Dr. Bretz worked closely with the Geology Branch of the Columbia Basin project during his 2 weeks of field work in the basin this trip, having the assistance of W. E. Walcott, district geologist for the Bureau of Reclamation with headquarters in Ephrata. Dr. Bretz also was joined by a coworker from Kansas, Prof. Harold T. U. Smith.

Among the cases of new evidence in support of his theory, cited by Dr. Bretz were gravel pits in the vicinity of Moses Lake. Here, in the area where new settlers are seeking their wealth through irrigating rich topsoil untouched by the runoff, Dr. Bretz found vast stores of "unsorted gravel," which evidently had been pushed headlong by a huge volume of water.

"Some of my opponents say 'less water and more time'," the noted geologist declared. "But a small volume of water couldn't have moved that mountain of material and boulders and gravel, even given a billion years, and left it the way I found it there.



"Granite boulders up to 15-feet maximum diameter were transported from the head of the Grand Coulee by this torrent to a point as far south as half way between Ephrata and Moses Lake, more than 50 miles away."

Dr. Bretz believes that the cascading flood of glacial Lake Missoula entered the 12,000 square mile area on a 100-mile front reaching from Cheney west to Grand Coulee from the North, cutting and enlarging three major valleys. One was the Grand Coulee (see map on this page) which man has utilized anew to put waters on the sagebrush lands of the Columbia Basin project, ultimately planned to reclaim more than a million acres.

A second compound channel runs south between Davenport and Wilbur, Wash.; the third channel extended south across the present site of Spokane, by Cheney, Wash., to the Snake River.

He believes that the Palouse River, which took the Spokane, Cheney flood runoff, once flowed along Washtucna Coulee past Connell and Mesa, along the southeasterly boundaries of the Columbia Basin project, and south down Esquatzel Coulee, discharging into the Columbia River canyon near Pasco.

He believes the glacial flood by its very volume cut the present Palouse Canyon across the preglacial divide between the Snake and the old Palouse. Water and ice-rafted boulders were backed up the Snake River as far as Lewiston, Idaho, more than 100 miles upstream.

LONG LAKE DAM, lower left, aerial view. Ancient scablands at left, partly covered by new Reclamation reservoir. Main Canal takes off from right center. Below, aerial view looking north from Long Lake Reservoir, foreground; across 165-ft. Long Lake waterfall in Main Canal. ***Photos by F. B. Pomeroy, Region 1.***

The tremendous erosion by this flood of glacial water cut potholes in basalt rock up to 100 feet deep, left gravel bars 200 feet thick, and receded, leaving dry cataracts, the most famous of which, Dry Falls, is about 5 times the height of Niagara Falls and 7 times as wide.

The eastern Washington wheatland area, which makes the State the fifth greatest wheat producing State in the Nation (1950 figures), was greatly reduced in its potential by the flood which removed the rich topsoil, or loess, leaving only the barren, unproductive rock, which in places has a shallow top covering suitable for light grazing.

A total of 2,800 square miles was scoured clean. An additional 900 square miles are buried by gravel and sand.

The 1,029,000 irrigable acres of Columbia Basin project, with its 4,500 miles of canals and laterals, are being developed by the Bureau of Reclamation among the soils left largely untouched. In fact, some of them were built up as a result of the discharge.

Dr. Bretz is a former University of Washington professor. He did not start his field work on the origin of scablands until he moved to the University of Chicago.

"It's an epic story you have here on the Columbia Plateau," Dr. Bretz said. ###

THE BIG SPLASH—Look at Long Lake drop. Main Canal pours into reservoir behind Long Lake Dam. ***Photo by F. B. Pomeroy, Region 1.***

New Members of the Interior Secretariat

Colonel Ralph A. Tudor, Under Secretary, former Governor Fred G. Aandahl of North Dakota, Assistant Secretary——Water and Power, and Mr. Orme Lewis of Phoenix, Ariz., Assistant Secretary are the new top ranking aides to Secretary of the Interior McKay.

Governor Aandahl became Assistant Secretary—Water and Power on February 10. In this capacity he exercises supervision over the Bureau of Reclamation; Bonneville Power Administration; Southwestern Power Administration; and Southeastern Power Administration. Pending the apppointment of Commissioner for the Bureau of Reclamation, Governor Aandahl was designated by Secretary McKay to act as Commissioner.

He was born in Litchville, N. Dak., in 1897, and is a graduate of the University of North Dakota. He served three terms as Governor, and was a member of the 82d Congress in 1951–52.

Assistant Secretary Lewis assumed his new duties February 20. He was born in Phoenix, Ariz., in 1902, and is a graduate of George Washington University, Washington, D. C., where he received his LL.B degree in 1926. He has practiced law for a number of years, primarily engaged in the field of business and corporate law particularly with relation to irrigation and other western problems. Secretary Lewis has charge of the public land management programs of the Department and directly related activities.

Under Secretary Tudor was born in Colorado Springs, Colo. in 1902. He is a gradnate of the United States Military Academy at West Point where he received his B. S. Degree. He did postgraduate work at Cornell University, specializing in hydraulics and earned a degree in Civil Engineering in 18 months.

Colonel Tudor is highly regarded in engineering circles, having worked for the Corps of Engineers, the California Division of Highways as well as serving in the capacity of Vice President for the Morrison-Knudsen International Company.

Some of the highlights of his career include preparation of basic plans for McNary and the Dalles Dams; Chief Engineer on studies for highway crossing of the San Francisco Bay; consultant on a San Francisco Bay Bridge between San Rafael and Richmond and Chief Engineer in charge of plans for rehabilitation of roads, waterways and ports in China.

Colonel Tudor took office on March 31.

Mr. Felix E. Wormser of New York was nominated Assistant Secretary for Minerals by President Eisenhower as this issue went to press.

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LONG DISTANCE ROAD SPRINKLING is much more efficient with this type of equipment. *Photo by Maurice N. Langley, Region 3.*

YUMA'S CANAL ROAD SPRINKLERS

Members of the Yuma County Water Users Association on the Valley Division of the Yuma project in Arizona have solved one of the problems of keeping their canal roads in good shape.

During the summer months of 1950 the operating roads along the Valley Division became so dry and dusty that it was very expensive and time-consuming to maintain them properly with ordinary maintenance equipment. It was apparent that, if operating roads could be thoroughly wetted, motor graders could then smooth the surface and fill the ruts and chuckholes with wet material. At that time the Bureau of Reclamation had four sprinkler trucks in operation. If they had no interruptions or breakdowns, each truck could apply 8 to 10 loads of approximately 1,000 gallons each, to operating roads in an 8-hour day.

The roads were so dry that it was necessary to make 4 or 5 applications with sprinkler trucks on each section of road before it was sufficiently saturated to blade. The cost of operating the sprinkler trucks was about $3.00 per hour each, plus the cost of drivers. This was so prohibitive that the sprinkling was discontinued. As a result, the operating roads became so rough that it was difficult to keep radio pickup trucks in mechanical or electrical repair. Finally, in November 1950, William L. McCaig, Head of the Maintenance Section of the Bureau asked Mr. John L. Williams, the Maintenance Superintendent in charge of equipment, to develop a sprinkler which would pump water directly from the canals onto the roads through a spraybar.

After some experimentation and with the assistance of Bureau shop foreman Charles Fay, Williams mounted a 4-inch pump on a trailer with a side boom from which a suction line could be suspended and dragged in the canal. This 4-inch pump can lift approximately 40,000 gallons of water per hour out of the canal onto operating road surface. By blading a ridge of dirt along both sides of the operating road ahead of the sprinkler pump, the water can be ponded on the road surface and allowed to sink in. Thus, it is

obvious that considerably more water can be applied with the pump unit in an hour than the four trucks had been able to apply in a day.

Mr. Williams, who designed the earlier model of the sprinkler rig described above, went to work for the Water Users Association. In this new capacity he supervised the construction of a similar water wagon which is now used by the Association. According to Mr. Harry S. Riddell, the present project manager, Jose Munoz and Francis Baker, machinist and welder did most of the construction work on the machine.

The equipment consists of a 4-inch self-priming water pump mounted on a two-wheel trailer, with a derrick and boom to operate the suction hose. There is a 16-foot aluminum pipe for intake from which about 4 feet of rubber hose hangs into the canal. This has an elbow in it which holds the hose straight. The pump discharges into a 4-inch T manifold and there are 4 homemade nozzles that are spaced across the 4-inch pipe. There is a piece of aluminum tubing on which the boom is mounted set on a ball bearing so that the boom can be swiveled to either side of the canal. This boom can be dismounted for road traveling. The 16-foot suction pipe is controlled by a hand operated handle on a cable drum mounted on the side of the stand which supports the boom and the derrick.

In the Bureau's work it was found that it was not practical to use the tractor-drawn trailer in areas which were some distance away from headquarters. Either the equipment had to be loaded onto a large tractor trailer unit or considerable time was wasted on the road. To solve this problem one of the rusted-out tanks was removed from one of the old sprinkler trucks and a 4-inch pump was mounted directly on the truck chassis and equipped with a side boom and spray bar similar to the one used on the trailer. This equipment is now being used to wet down operating roads along canals and on all projects operated by the Bureau in the Lower Colorado River District. Operation, maintenance, and depreciation of this unit costs about $3.00 per hour plus the truck driver and laborers (at the present time drivers are paid $1.50 and laborers $1.35 per hour). This unit can cover from 2 to 4 miles of road per hour, depending upon the amount of water it is desired to apply. Very little time is lost getting around structures since the laborer merely winds up a windlass and lifts the suction line up to the side boom to pass over the structure. Once past the structure, the suction line is lowered and the self-priming pump immediately picks up a new prime and starts operating.

At present prices the total cost of the entire pump and spray unit, assembled and ready to set on a truck chassis ranges from $1,200 to $1,500.

###

FOR LOCAL SPRINKLING use tractor trailer rig. *Photo by Clorence Borsuk, Yuma County Water Users Association.*

MAN-MADE Garden Spot in lush 356,000-acre Boise project. Black Canyon canal is in foreground. *Photo by Phil Merritt, Region 1.*

The Crops of CANYON COUNTY

by FLORENCE M. STEWART
County Home Demonstration Agent
Canyon County, Caldwell Idaho

Canyon County in Southwest Idaho in the heart of the Boise project is truly a garden spot. It is a part of the Boise Valley which is irrigated from storage in the Arrowrock and the Anderson Ranch Dams. The Lucky Peak Dam, now under construction for flood control, will furnish a supplemental supply of water if needed.

Land is so productive in this area that you have to see it to believe it. In 1950, a 4–H Club girl raised 44 tons of beets per acre on her 3-acre project. The county average taken from the 1950 census showed an average of 22.74 tons per acre from 15,597 acres, some of which has been under irrigation but a few years. Her 3 acres were free from alkali, and had been heavily manured. For years it had been a part of a 14-acre pasture. The other 11 acres of the same field yielded 36 tons per acre the same year.

Three cuttings of alfalfa (and sometimes more) are the usual thing. Farmers start cutting hay before you hardly know that spring is here. Statistics show that the average for the county is a strong 3.8 tons per acre from 38,832 acres. Seed crops are high: 1,727 acres produced 235.6 pounds of seed per acre. Farmers produced 308.5 pounds of red clover seed per acre from 6,642 acres to say nothing of the clover and alfalfa honey produced.

Garden seed, including popcorn, is a big crop. Onion seed fields are beautiful with their tall green tops, capped with a big white ball filled with seed. In July, August, and September last year (1952) forty-nine railroad cars of seed were shipped from Caldwell alone. This does not include seed sold or stored locally, nor any that was trucked or otherwise shipped from other towns. Seed crops shipped were: onion, carrot, peas, and corn. In this same period 372 cars of potatoes, 23 cars of fresh vegetables and 86 cars of fruit were shipped by rail. From October 1951 to March 1952, inclusive, 195 cars of seed were shipped from Caldwell alone.

Vegetable growers in this county have almost one-third of the acreage in the State, and receive over 46 percent of the income from vegetables sold. The chief crops grown are onions, potatoes, sweet corn, beans, peas, lettuce, and carrots. The

income from 6,439 acres was $1,556,221.00 in 1950, an average of approximately $242 per acre.

Fruits are raised in abundance in some sections of the county, also. Predominating tree fruits are prunes, apples, peaches, cherries (sour and sweet), and apricots. The yield of each runs into hundreds of thousands of bushels. Prunes lead production with 325,934 bushels. Sweet cherries yielded 777,536 pounds according to the 1950 censns. In late summer, after the fruit has been thinned, farmers use props to prevent fruit laden limbs from breaking down. After harvest, the props, stacked to look like tepees, resemble an Indian Village.

Strawberries, blackberries, dewberries, raspberries, boysenberries, loganberries, and youngberries grow abundantly. Strawberry production leads with 969 quarts per acre from 56 acres.

Small fruit farmers supply the berries and the dairymen pour on the cream. With 26,200 cows in Canyon County, 25,600 in Ada County, and 3,900 in a small portion of Owyhee County—just across the Snake River—this section of Idaho, known as the Boise Valley, had a butterfat production of 44 million pounds in 1951. The dairy industry ranks first in income with the receipts from sales of dairy products amounting to $11,805,875.00. Cows in this area are not the "old brindle" type by any means. Farmers are in the dairy business for high production, and at the same time they have in mind crop rotation and soil building. The old barrel churn was relegated to the attic about the time old brindle died.

Several dairy products are processed in one way or another here at home. There are 4 Grade A plants, and 4 manufacturing plants. In 1951 dairy sales included 3,520,000 pounds of butter, 2,038,000 pounds of butterfat sold in products other than butter, and 9,000,000 pounds of skim milk powder. A large plant in Nampa cans evaporated milk. Ice cream, anhydrous milk fat, skim and whole milk powder, condensed milk, cottage cheese, and grade A milk are other products of the valley.

Quantities of fruit and vegetables, also, are processed in the county. Potatoes and onions are dehydrated. Other vegetables and fruits, some of which are corn, asparagus, cherries, and prunes, are canned or frozen on a commercial scale.

How is all this production possible? Because the water has come! Our forefathers had a vision backed by scientific "know how." Dams have been, and are being, built in the foothills and in the mountains to catch the runoff. This water storage is released when and where it can best be utilized. Some of the fields are watered by gravity flow from storage reservoirs and some by pump irrigation. On certain terrain and some types of soil the sprinkler system is used.

Farmers utilize fertilizer and water; they destroy weeds and insect pests; they rotate crops; they select good seed; they work long hours. It is not all a bed of roses, but they "keep on keeping on" and are happy in doing it. With the life-saving water, their land continues to produce. The goal is nearing—some of the comforts of life, and their own homes, for their families. ###

HEALTHY GUERNSEYS help to balance crop production and provide profitable employment throughout year. *Photo by Ston Rosmussen, Region 1.*

NITROGEN AIDS COTTON CROP under irrigation at Brawley, Calif. One hundred sixty pounds of nitrogen increased the yield by 0.8 bale per acre. *All photos courtesy of BPI, Department of Agriculture.*

NITROGEN IN THE WEST

PART 2—NITROGEN AND YOUR DOLLAR

How Nitrogen Fertilizer Increases Yields

by OMER J. KELLEY, Principal Soil Scientist
Division of Soil Management and Irrigation
United States Department of Agriculture

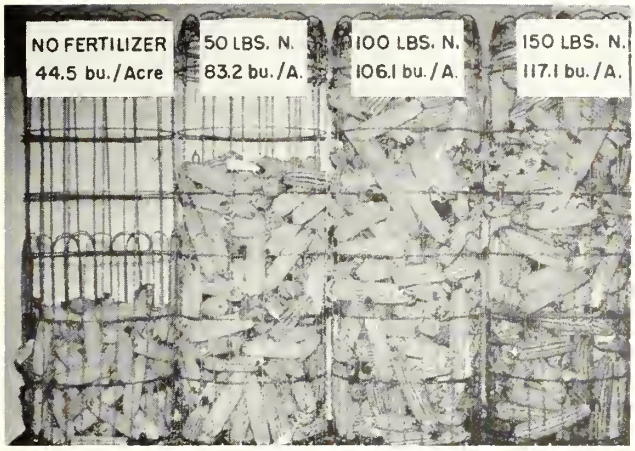
Research men throughout the West report markedly increased yields of nonlegume crops through the use of nitrogen. These increases usually are lower on dry land than on irrigated lands because of lack of moisture.

Here are a few data from nitrogen trials on irrigated lands showing the value of nitrogen in increasing yields. On depleted soils at Scottsbluff, Nebr., corn yields were increased from 40 bushels per acre to 120 bushels per acre by applying 120 pounds of nitrogen per acre. Experiments with sugar beets in Utah resulted in yield increases averaging 6 tons per acre from 160 pounds of nitrogen. At Brawley, Calif., where the control plot with no nitrogen yielded 2.45 bales or an increase of 0.8 bale per acre, an addition of 160 pounds of nitrogen gave a yield of 3.25 bales or an increase of 0.8 bale per acre. At Tucumcari, N. Mex., grain sorghum yields were increased 40 bushels per acre with 120 pounds of nitrogen. In Colorado and Wyoming 160 pounds of nitrogen increased yields of Mountain Meadow hay by as much as 2.5 tons per acre. Many more equally striking benefits could be quoted.

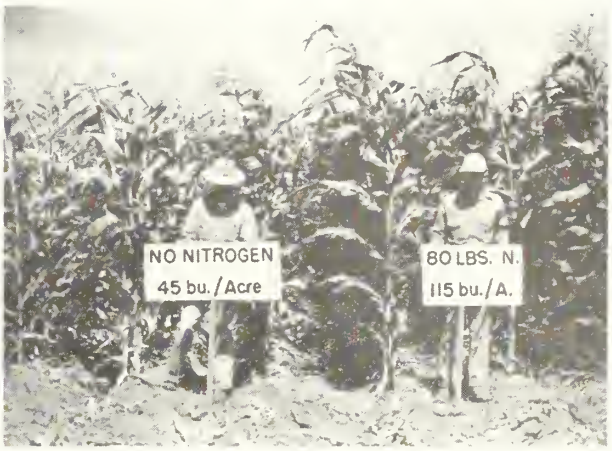
Various Factors Influence Nitrogen Efficiency

Many things influence the magnitude of crop response that can be expected from the use of nitrogen fertilizer. Two of the important things to know are how much manure was applied previously, and how much alfalfa was grown in the rotation. Then, too, some crops require more nitrogen than others. But there are several factors that will influence how much a given crop on a given piece of land will respond to nitrogen. As a matter of fact experiments show that the manner in which a crop responds to nitrogen depends upon almost any thing that will affect plant growth: thickness of planting, the soil moisture conditions, time and way the nitrogen is applied; the method of irrigation, and the amount of other fertilizer elements applied.

A corn experiment in the Columbia Basin demonstrates how irrigation frequency influences nitrogen response. In this experiment two irrigation treatments were set up. In the drier treatment, 3 irrigations were made or a total of 12 inches of water was applied. In the wetter treatment, 8 irrigations, or a total of 24 inches, was applied. When 240 pounds of nitrogen was applied, the corn yield was increased 79 bushels on the wet treatment, and only 35 bushels on the dry



RESULTS SPEAK for themselves.



WITHOUT NITROGEN—With nitrogen.

treatment. For the dry treatment, 80 pounds of nitrogen gave maximum yields; on the wet treatment the yield increased up to 240 pounds, with about 160 pounds of nitrogen being the most economic rate.

Other experiments have shown that the time of applying nitrogen on corn is not so important—if (and this is a big "if") there is enough nitrogen in the soil to meet the maximum requirement of the plant. In the case of corn, this "maximum requirement" occurs during the period when the plant is starting to approach maturity—from a little before tasseling on. Also, some corn hybrids may do best under an intermediate level of nitrogen while others give maximum performance under high levels of nitrogen. The same appears to hold for different varieties of barley.

You will be interested in knowing that nitrogen applied during 1 year will carry over into the next. Usually the largest amounts applied give the greatest residual responses. For example, in North Dakota 120 pounds of nitrogen applied on corn in 1950 increased the yield of the 1951 barley crop by 27 bushels. Of course, on extremely sandy soils any extra nitrogen may be leached out of the root zone. In fact, on irrigated sands it is often desirable to split the nitrogen application and to apply it at intervals during the season. This assures keeping a nitrogen supply within reach of the plant roots throughout the growing season.

Nitrogen Affects Quality

Nitrogen affects the quality as well as the quantity of plant material produced. In Colorado and Wyoming, the protein content of Mountain Meadow hays has been increased greatly when nitrogen fertilizers have been combined with proper irrigation. In nearly all cases nitrogen fertilizers increase the protein content of dryland wheat regardless of whether or not they increase the yield. In the Columbia Basin in Washington the protein content of corn has been markedly increased by adding nitrogen fertilizers.

Too much nitrogen fertilizer sometimes has a bad effect on the crop. With sugar beets, it is easy to reduce the percentage of sugar to the point where the favorable effect of nitrogen on increased tonnage is partly or fully nullified. As a rule, intermediate amounts of nitrogen will increase beet yields without seriously reducing the sugar content. Also, too much nitrogen on small grains may damage the stand of the new seeding. In other instances, small grains may lodge.

All Problems Not Answered

While we know a lot about the use of nitrogen fertilizers, there is still a lot more to learn. We need to be able to predict just how much nitrogen should be applied for a given crop on a given field. This involves knowing how much nitrogen will be available in the soil in order that we can figure how much extra nitrogen we must apply. We need to develop sound soil tests to help determine this. We need to know what happens to the nitrogen when it is applied to the soil. What about the addition of nitrogen to irrigation water? Very little scientific information is available. For instance, on calcareous soils of the Southwest we suspect that ammonia forms of nitrogen are dissipated into the air, but we aren't sure. Insofar

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EARLY DAYS ON THE SALT RIVER PROJECT

by OLIVER T. REEDY, M. ASCE
Consulting Civil Engineer (retired) Denver, Colorado

THE WHOLE STORY OF RECLAMATION in Arizona is interesting, but to me that which deals with the early days of the Salt River project is absorbing. I was there.

Shortly after President Theodore Roosevelt signed the Reclamation Act on June 17, 1902, I became the 20th engineering appointee in the Reclamation Service on October 17, 1902.

If it had not been for slow mail service, I might have been among the first dozen engineers appointed to the Reclamation Service.

The offer of an appointment as assistant engineer from Morris Bien, assistant head of the Reclamation Service, caught up with me while I was on reconnaissance work for the Mexican Central Railway in the wild mountains between Tampico and Mexico City. Our mail was always several weeks in reaching us.

Early in November 1902, I reported for work in Phoenix. On November 6th I set up an engineer's level on a Mesa street, and starting from a bench mark in front of the Alhambra Hotel, began a line of levels to control such stadia surveys in the Salt River Valley.

Chief Engineer Frederick H. Newell, head of the Reclamation Service, had prints made of my contour map of the township in which Mesa is located and sent them out to other projects as a sample of the work required. Among other maps made by my field party were Lehi, Camelback and Glendale townships. Late in 1903 I was sent up to Livingstone to make plane table surveys for the Power Canal which was built to supply power for operating the cement mill and other machinery in building Roosevelt Dam. Shortly thereafter I succeeded the engineer in charge of canal surveys. When they were completed, the job of final location and construction of the Upper Section, including the Diversion Dam and Intake was assigned to me.

The Upper Section of the Power Canal was about 11 miles long, consisting of open excavation

by horses and scrapers, 12 tunnels in all stages of construction, concrete drainage structures, a bridge or two, the Intake structure and Diversion Dam, and what I believe to be the first reinforced concrete pressure-pipe built by the Reclamation Service—the Pinto Creek Siphon. I was in the saddle most of the time on inspection, and my

A FAR CRY from modern construction camps was the damsite camp at Livingstone, Ariz., shown in above photo taken in 1904. Note 6-mule heavy freight wagon and trailer, with pack outfit in the rear, right foreground. Wagon and trailer were used especially to haul provisions from Globe, 40 miles distant. Horse and scraper action in lower left photo. Mr. Oliver T. Reedy at plane-table with alidade is at right. *All photographs courtesy of author.*

bride (we were married in Stromsburg, Nebr., on September 20, 1904) tagged along astride her cow-pony Captain, wearing her cartridge belt and pearl-handled Colt six-shooter.

I have only one picture showing actual work by horse and scraper. It is far from representative of the magnitude of the work. Most of the time there were several hundred teams of horses on the job. This picture does show an interesting aspect of early construction. Most of us younger fellows were somewhat green on that class of work, and in selecting the canal cross-section our designer used the one which gave the maximum discharge with minimum excavation, without taking into account methods and details of construction. This called for a narrow base, deep flow and steep side slopes. It resulted in creating the problem of getting the teams in and out of the ditch, and turning them around in a deep cut with a bottom width of 8 feet.

The picture shows comparatively easy digging. On some portions it was necessary to use a heavy rooter plow handled by 2 men and pulled by a 6 horse team. This made an outfit at least 35 feet long. They were guided with a jerk-line and oral directions, principally the latter.

The complete structure was not built until after I left the project in 1906 to do some townsiting for a brother-in-law in Nebraska, and when I returned to the Service I was assigned to another project. But Arizona remained a fond memory, and in February and March 1951, my wife and I spent several weeks in Mesa and Phoenix, recalling some of those cherished experiences of almost half a century ago. We took a trip to the canal and headworks, but before leaving for the Intake Dam and Canal, I visited the Water Users Association offices, where I was most cordially received as an old-timer and given maps and useful information. I asked the Superintendent if it would be difficult to find the abandoned canal. I assumed it had been abandoned when water from the Reservoir was turned into the penstock. He replied, "Abandoned? It's been abandoned several times and always brought back into service. Just now it's a Godsend while the reservoir is drained for repairs. It is the source of all the power we have up there." I was surprised and pleased.

I feel very gratified over having been associated with the beginnings of the Salt River project and other early activities of so magnificent an organization as the Bureau of Reclamation. ###

Nitrogen

Continued from page 97

as adding nitrogen to water and applying by flood or furrow irrigation method is concerned, where such losses are not a problem, the nitrogen should be distributed in the same manner as the water. If good distribution is obtained, the method should be as efficient as applying the solid form. However, care should be taken to avoid excess leaching. Furthermore, we know very little about the nitrogen needs of a series of crops when grown in rotation. What is the nitrogen balance? How much nitrogen do legumes provide, how much do we get from manure, and how much do we have to add? Can we spray liquid nitrogen profitably on dryland wheat with airplanes? These are just a few of the problems still facing us. ###

How To Apply Nitrogen

by VANCE T. SMITH, Soils Specialist, University of Idaho Extension Service

Side dress or broadcast. It doesn't make much difference how you get nitrogen on beets and potatoes. Results at the Aberdeen branch experiment station, University of Idaho, have indicated that equal results are obtained either way. This means that nitrogen can be applied with whatever equipment you have. I might give one word of caution about the broadcast method, and that is for best results the nitrogen should be placed in the soil rather than on it. I realize that when you broadcast a fertilizer it goes on the surface. What I mean is that it should be worked in either by plowing or fairly deep disking.

When it comes to the practical use of fertilizers, a time must be chosen for doing the job. A beet sugar company is recommending that fertilizer be applied in the fall prior to fall plowing. It advocates fall plowing for beets and urges that the fertilizer be placed on the field before plowing. In our relatively low rainfall areas I endorse these recommendations. However, in areas of high rainfall where soluble fertilizers like nitrogen could be moved below root depth with heavy precipitation, I would wait and apply it on the field during seedbed preparation in the spring. #

Thanks To The Tribune

EDITOR'S NOTE: *We wish to extend our appreciation to the Salt Lake Tribune for the excellent portrait of Mr. William R. Wallace which appeared in the "Hall of Fame" article in the March 1953 issue of the Reclamation Era.*

WATER REPORT

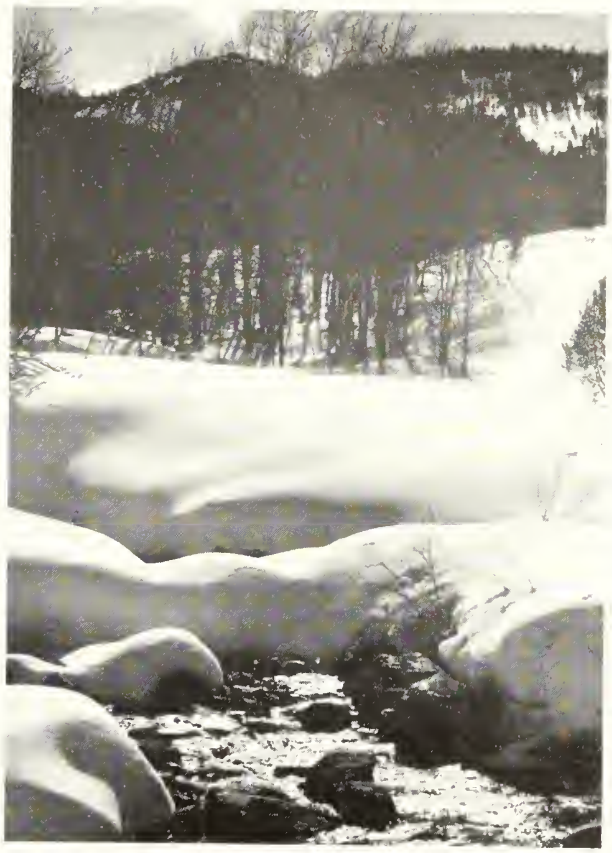
OUTLOOK FOR 1953 WATER SUPPLY OF THE WEST

by R. A. WORK, Senior Irrigation Engineer, and CLYDE E. HOUSTON, Irrigation Engineer, both of the Soil Conservation Service, United States Department of Agriculture

Irrigations farmers, public and private power utilities, and all other water users in Western States are now receiving the most accurate and comprehensive information to be had on prospective water supplies through a recently coordinated forecasting program by the several agencies involved.

Under this new cooperative arrangement, which became effective January 1, 1953, the United States Weather Bureau, United States Soil Conservation Service, and California Department of Public Works continue to issue their respective water supply forecast and snow-survey water forecast publications after prior collaboration among the respective agencies.[1] The Weather Bureau's "Water Supply Forecasts for the Western United States" published monthly from January through May, now contains all of the forecasts made by all three agencies.

Coordinated early season evaluation of potential flood hazard on snowmelt rivers, which are presented in the respective publications in years of heavy snow cover, draw upon both snow-survey and precipitation data. Weather Bureau river district offices will continue to prepare and issue short range forecasts of river stages. The Soil Conservation Service will continue to make available to Soil Conservation District farmers, irrigation districts and others, operational advice based on these outlooks and forecasts.



SNOW MELT which will provide water irrigation for parched acres this summer. *Photo by Robert Branstead, Soil Conservation Service, United States Department of Agriculture.*

The water supply outlook for Western States for the irrigation season now underway as viewed by these agencies, is much less promising than last season. Threatening water shortages are foreseen for numerous areas, particularly in New Mexico, southern Utah, southern and central Nevada, and parts of Arizona and Colorado. The following State-by-State inventory gives a more detailed accounting of irrigation season runoff prospects, as reported to the Soil Conservation Service by the snow surveys.

ARIZONA—Only two major winter storms three months apart covered Arizona last winter. These two big storms brought about normal rainfall for the period October–March to southern Arizona but only 72 percent of the seasonal normal to northern Arizona. Snow cover has been below normal most of the winter. Above normal winter temperatures and heavy evaporation losses further reduced the northern Arizona snow pack. Because of snow pack losses, and total deficiency of snow cover it is forecast that flow of the Salt River will equal only 50 percent normal for April–May. Flow of the Verde River for the same period is not expected to exceed 35

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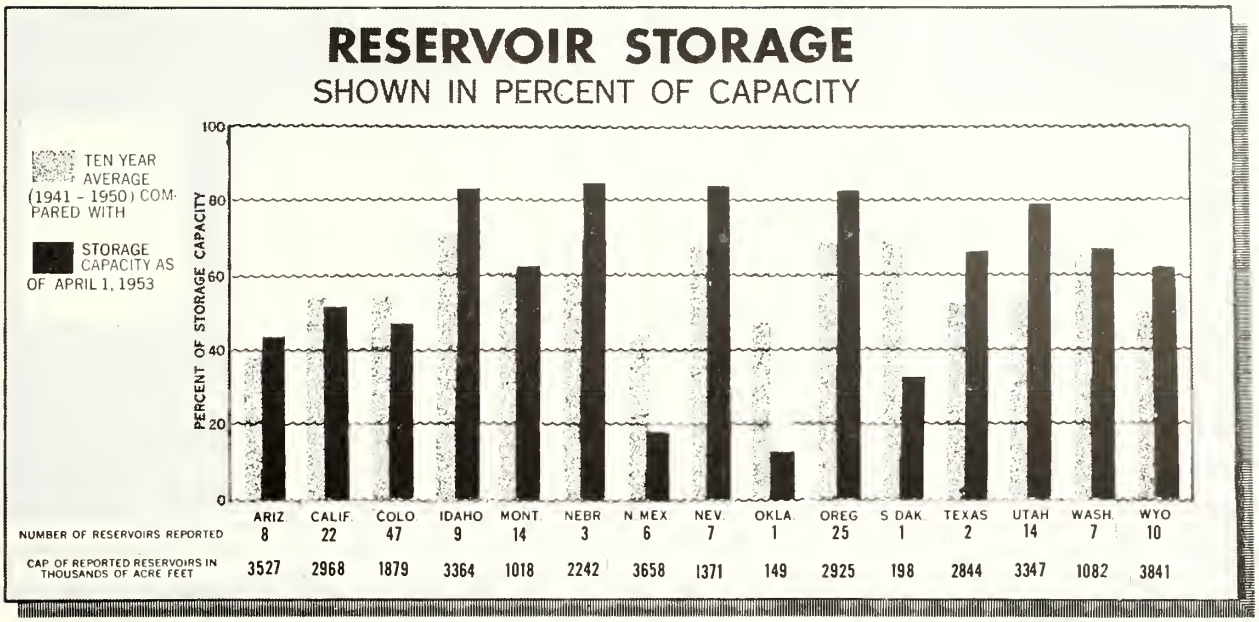
[1] The Soil Conservation Service is the Federal Coordinating agency of snow surveys conducted by its staff and many cooperators, including the Bureau of Reclamation, Forest Service, National Park Service, Geological Survey, various departments of the several Western States, irrigation districts, power companies, and others. The California State Division of Water Resources conducts and coordinates snow surveys in that State, while the British Columbia Department of Lands and Forests, Water Rights Branch, has charge of the snow surveys in that province. The U. S. Weather Bureau makes westwide water supply forecasts at more than 320 gaging stations, such forecasts being estimated principally on the basis of measurement of precipitation. The Weather Bureau forecasts are for the water year (October–September, inclusive) whereas, snow survey forecasts are always for the irrigation season only.

Water Stored in Reclamation Reservoirs

Location	Project	Reservoir	Storage (in acre-feet)		
			Active capacity[1]	Mar. 31, 1952	Mar. 31, 1953
Region 1	Baker	Thief Valley	17,400	[2]	[2]
	Bitter Root	Lake Como	34,800	13,600	5,600
	Boise	Anderson Ranch	464,200	70,300	255,100
		Arrowrock	286,500	19,600	231,200
		Caseade	650,000	110,800	98,800
		Deadwood	161,900	31,900	68,650
		Lake Lowell	169,000	148,200	162,000
	Burnt River	Unity	24,600	7,200	15,100
	Columbia Basiu	F. D. Roosevelt	5,220,000	1,070,000	2,183,600
	Deschutes	Crane Prairie	50,000	47,000	50,000
		Wickiup	182,000	177,000	199,000
	Minidoka	American Falls	1,700,000	1,392,200	1,658,200
		Jackson Lake	847,000	520,000	441,900
		Lake Walcott	95,200	80,000	93,200
		Grassy Lake	15,200	13,200	12,800
		Island Park	127,300	74,800	102,500
	Okanogan	Conconully	13,200	8,400	8,300
		Salmon Lake	10,500	10,100	9,700
	Owyhee	Owyhee	715,000	531,200	574,400
	Umatilla	Cold Springs	50,000	49,600	44,200
		McKay	73,800	44,600	65,300
	Vale	Agency Valley	60,000	38,700	46,600
		Warm Springs	191,000	90,600	165,000
	Yakima	Bumping Lake	33,800	4,800	14,700
		Cle Elum	435,700	258,900	240,100
		Kachess	239,000	184,300	170,500
		Keechelus	153,600	86,100	121,500
		Tieton	197,000	123,100	133,200
Region 2	Central Valley	Millerton Lake	500,000	247,800	292,900
	Klamath	Shasta	4,366,800	3,849,200	3,621,800
		Clear Lake	513,300	156,800	280,600
		Gerber	94,300	26,200	77,100
		Upper Klamath Lake	524,800	323,500	443,900
	Orland	East Park	50,600	48,500	50,400
		Stony Gorge	50,000	48,900	51,600
Region 3	Boulder Canyon	Lake Mead	27,207,000	15,691,000	17,764,000
	Davis Dam	Lake Mohave	1,809,800	1,586,500	1,639,000
	Parker Dam Power	Havasu	688,000	600,900	618,500
	Salt River	Bartlett	179,500	156,000	48,000
		Horse Mesa	245,000	233,000	236,000
		Horseshoe	144,000	118,000	1,030
		Mormon Flat	57,800	52,000	52,000
		Roosevelt	1,381,600	682,000	1,049,000
		Stewart Mountain	69,800	50,000	51,000
Region 4	Fruit Growers	Fruit Growers	4,500	300	4,600
	Humbolt	Rye Patch	179,000	114,700	150,000
	Hyrum	Hyrum	15,300	10,400	15,700
	Mancos	Jackson Gulch	9,800	800	3,900
	Moon Lake	Midview	5,800	4,500	5,000
		Moon Lake	35,800	22,700	21,100
	Newlands	Lahontan	290,900	146,400	273,200
		Lake Tahoe	732,000	504,000	552,000
	Newton	Newton	5,400	3,500	5,300
	Ogden River	Pine View	44,200	3,200	19,500
	Pine River	Vallecito	126,300	26,600	56,300
	Provo River	Deer Creek	149,700	108,700	116,700
	Scofield	Scofield	65,800	33,800	50,400
	Strawberry Valley	Strawberry	270,000	153,300	249,800
	Truckee River Storage	Boca	40,900	2,700	6,200
	Uncompahgre	Taylor Park	106,200	55,500	64,100
	Weber River	Echo	73,900	13,300	46,800
Region 5	W. C. Austin	Altus	145,000	99,200	17,600
	Balmorhea	Lower Parks	5,900	6,400	5,500
	Carlsbad	Alamogordo	131,900	23,200	32,000
		Avalon	6,600	1,800	3,600
		McMillen	38,700	[2]	200
	Colorado River	Marshall Ford	810,500	21,500	800,600
	Rio Grande	Caballo	345,960	78,600	137,000
		Elephant Butte	2,197,600	19,100	277,700
	Tucumcari	Conchas	269,100	108,700	74,600
Region 6	Missouri River Basin	Angostura	92,000	41,000	50,600
		Boysen	560,000	152,400	495,000
		Heart Butte	68,700	60,700	62,400
	Belle Fourche	Belle Fourche	185,200	117,800	65,600
	Fort Peck	Fort Peck	11,400,600	7,821,500	8,173,300
	Milk River	Fresno	127,200	145,000	85,900
		Nelson	68,800	37,000	29,700
		Sherburne Lakes	66,100	[2]	18,900
	Rapid Valley	Deerfield	15,100	15,100	13,900
	Riverton	Bull Lake	155,000	61,200	56,000
		Pilot Butte	31,600	13,600	23,500
	Shoshone	Buffalo Bill	394,600	202,300	154,800
	Sun River	Gibson	105,000	66,900	58,400
		Pishkun	30,100	23,000	17,500
		Willow Creek	32,400	25,400	21,400
Region 7	Colorado-Big Thompson	Granby	467,600	201,900	350,400
		Green Mountin	146,900	77,000	78,500
		Horsetooth	151,700	68,700	116,200
		Shadow Mountain	1,800	1,400	1,500
	Missouri River Basin	Bonny	[2]	33,400	28,900
		Cedar Bluff	131,700	97,400	69,700
		Enders	36,000	30,400	25,700
		Harry Strunk Lake	35,000	33,400	32,600
	Kendrick	Alcova	190,300	158,800	155,400
		Seminoe	993,200	502,800	546,900
	Mirage Flats	Box Butte	30,600	31,200	22,400
	North Platte	Guernsey	44,200	34,900	30,600
		Lake Alice	11,400	[2]	2,700
		Lake Minatare	60,800	28,200	22,000
		Pathfinder	1,040,500	937,000	867,400

[1] Available for irrigation.

[2] Not reported.



Explanation: Most State averages for reported reservoirs are for full 10 year period, but in a few cases reservoirs having shorter records are included. Does not include Millerton or Shasta reservoirs (combined capacity 5,020,500 acre-feet); April 1 combined storage 4,061,100 acre-feet. Does not include John Martin reservoir (capacity 655,000 acre-feet); April 1 storage 20,000 acre-feet. Does not include Fort Peck reservoir (capacity 19,000,000 acre-feet); April 1 storage 12,750,000 acre-feet. Does not include Flathead Lake (capacity 1,791,000 acre-feet); April 1 storage 641,000 acre-feet. Does not include Hungry Horse reservoir (capacity 3,500,000 acre-feet); April 1 storage 719,700 acre-feet. Does not include Lake Mead (capacity 27,217,000 acre-feet); April 1 storage 17,764,000. New reservoir in 1945. Does not include Roosevelt Lake (capacity 5,220,000 acre-feet); April 1 storage 2,183,000 acre-feet. Does not include Boysen reservoir (capacity 820,000 acre-feet); April 1 storage 557,000 acre-feet. (These are total capacities—the table on page 102 shows active capacity available for irrigation.—Ed.)

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percent of the 10-year normal, 1941–50, and flow of the Gila seems likely to equal only 15 percent normal for the same period. Inflow into the Salt-Verde system peaked about March 21—irrigation requirements then began to exceed streamflow.

Fortunately, fairly substantial water reserves have been accumulated on the Salt-Verde system—not quite as good as last year but at least better than the past 10-year average. Roosevelt reservoir now stores 1,049,000 acre-feet compared with 682,000 acre-feet last year and 652,000 acre-feet average for the 10-year period, 1941–50. However, important San Carlos reservoir on the Gila River now stores water only to 1 percent of capacity, with dismal prospects for further inflow. Last year San Carlos stored 160,000 acre-feet on April 1—12 percent of capacity. Storage on April 1, 1952 was only 14,500 acre-feet.

In recent years increasingly efficient water management is being practiced by farmers and irrigation companies in Arizona. It seems evident that the sharpest sort of water management will be called for in Arizona in 1953.

Flow of the Colorado River into Lake Mead for April–September will be about 60 percent of normal or near the minimum flow experienced since the reservoir was completed.

California—Water conditions in California are generally unsatisfactory except in the Klamath and Upper Sacramento Basins. Deficient precipitation during February and March resulted in far less than normal increments to the snow pack, the water impounded in reservoirs, and the water levels of the groundwater basins. The outlook for California based on the availability of surface water to meet irrigation demands during 1953, although generally unsatisfactory does not appear to be critical except in portions of Southern California and the southern San Joaquin Valley. Power output in the State will not be adversely affected by the deficiencies in surface water supply due to the high degree of integration among major hydro- and steam-electric plants.

The snow pack throughout the Cascade Mountains and the Sierra Nevada is considerably less than that of 1 year ago. Water content varies from 120 percent of normal in the upper Sacramento River watershed to about 60 percent of normal in the southern Sierra Nevada. Normal precipitation conditions for the remainder of the season will produce normal or above normal snow melt runoff in the north coastal area and the Sacramento River watershed above Shasta Dam. Snow melt runoff for San Joaquin Valley streams will vary from 45 to 75 percent of normal. Under the assumption of no additional precipitation during the remainder of the season, the indicated snow melt runoff during the April–July period would be near normal in the north coastal area and from 25 to 70 percent of normal in the Central Valley area.

Colorado—The flow of all streams originating in mountain areas in Colorado will be below normal for the 1953 season. Critical shortages of water are expected on the Arkansas, Rio Grande, and the southern tributaries of the South Platte. Actual flow will range from about 80 percent of normal on the upper Colorado River to 40 percent of normal on the Rio Grande and San Juan.

In irrigated areas on the South Platte and tributaries a shortage of water is expected except on the Cache la Poudre, Big Thompson, and lower South Platte. On these streams supplemental water will be available from the Colorado-Big Thompson project. Even normal water supply is usually inadequate for the highly developed South Platte irrigated area. Storage in smaller irrigation reservoirs is about the same as a year ago but below the average of past years. On the Arkansas River the outlook is very poor. Stream-flow there will be below normal; there is practically no reservoir storage and

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APPLYING WATER TOO FAST may endanger crops and soil.

INVESTIGATE before you INVEST

by CLAUDE H. PAIR, Irrigation Engineer Division of Irrigation Engineering and Water Conservation, Soil Conservation Service, Boise, Idaho

and L. R. SWARNER, Irrigation Engineer Bureau of Reclamation, Boise, Idaho

"FOR SALE—80 acre agricultural sprinkler system by owner."

So read an advertisement in a local newspaper last spring.

Fortunately, there have not been many "ads" like this. Fortunately, we say, not because we are opposed to the resale of irrigation equipment but because the chances are great that in the long run this system may prove to be the most expensive even though the purchase price is considerably below that of new equipment.

"How could such a system cost me more money than new equipment?" you ask. "Haven't I read where a sprinkler system saves water, saves labor and increases yields?" Yes, you probably have, but not every system will save you money, water, labor, or will produce more crops. How could this happen?

Buying a used sprinkler system is like going up to the suit rack of a local department store, picking up a suit, paying for it, and taking it home without trying it on for size, length of trousers and size of vest. If you were lucky it might fit, but the chances are great that it won't. A properly designed sprinkler system may be compared with a tailor-made suit. It exactly fits the farm for which it was designed. Using it elsewhere usually results in a misfit in one place or another.

Although we have pointed out the danger of buying a used sprinkler system which does not fit a farm, equal danger exists in buying a new system unless careful consideration is given to the factors which influence the design and operation of the sprinkler system. Generally speaking, sprinkler equipment dealers can be relied upon to design systems properly. However, it is possible for a farmer to purchase various parts of sprinkler equipment and assemble his own system.

A sprinkler system must be designed to fit the farm on which it is to be used, taking into consideration the maximum water requirements of the crops grown throughout the normal rotation. In general, revolving head sprinkler systems must

meet the following performance requirements:

1. *Application Rate*—Water should not be applied at a rate faster than the soil will take it in. However, it should be applied fast enough to prevent excessive evaporation loss.

2. *Depth of Application*—At the point of lightest application, the amount of water applied for an irrigation should not be greater than can be held by the soil within the root zone of the crop. Greater amounts should be applied only when leaching is necessary to remove harmful salts.

3. *System Capacity*—There should be enough equipment, and of sufficient size, to replenish soil moisture at a rate at least equal to the peak rate of use by the crop, taking into consideration the highest water use crop in normal rotation.

4. *Uniformity of Application*—Water should be applied as uniformly over the field as is practicable. The point of lightest sprinkling should usually have a depth of application of at least 80 percent of the average depth applied over the field. The uniformity of application is affected by variations between discharges of the individual sprinklers along a lateral and on different laterals. It is also affected by the uniformity of spray distribution within the effective area of individual sprinklers.

5. *Economical Pipe Sizes*—The initial cost of small-sized main and lateral pipelines is less than larger pipelines. However, small-size pipelines require more power than larger pipelines because of increased water friction. This increases the cost of sprinkler system operation. The distribution pipe size should be such that there is an economic balance between pipe cost and power cost.

6. *Crop Damage*—Water must be applied in such a manner that it will not physically damage the crop. If you are in the market for a sprinkler system, shop around among various dealers, but don't buy the cheapest system they offer because usually the cheaper system does not have enough lateral or sprinkler heads included to permit you to irrigate the farm properly during the high water demand period of your crop. Here, as in most cases, you get just what you pay for.

The lack of adequate moisture during the peak growing season results in a lowered production in some crops and, in other crops, lower grade produce. There is less income any way you look at it. The cheapest sprinkler system may prove very expensive in the overall seasonal operation if it is underdesigned for the farm.

Proper design alone is only one-half the key to success with a sprinkler irrigation system. It should be run in keeping with good irrigation practices. Too often farmers have the mistaken impression that a sprinkler system is a "cure-all" for all irrigation problems.

How should a sprinkler system be operated?, you ask. There are several general rules that should be followed.

1. Irrigate only when the crop needs to be irrigated. Keep in mind that there is a time lag for complete coverage of the farm with a sprinkler system. Once you get behind crop needs it is rather difficult to catch up because of the limit of the capacity of the system. Testing the soil moisture will determine when to irrigate. If soil moisture is adequate over the entire farm, shut off the sprinklers for a few days during this slack period. You'll save water and labor.

2. Apply only enough water to fill the soil with moisture throughout the root zone. Often when establishing new crops only a few inches of surface soil need to be moistened. The sprinkler system should be operated long enough to supply this moisture. One of the most common abuses is to operate it full-time throughout the entire irrigation season when it has been designed for full-time operation only during the period of peak moisture demand, which usually occurs during the midsummer months. This over-irrigation and the resulting loss of water occurs in the spring and fall. In addition to the cost of the extra water as well as the cost of applying it, overirrigation may carry valuable soluble nitrates below the reach of the plant roots. This would require the farmer to apply more fertilizer to obtain good crop production. Overirrigation may also cause drainage problems. If your sprinkler system is designed to cover the farm in 10 days during the peak water-use period, running continuously, then in the spring and fall it will need to run only one-third to one-half that time.

For successful results with a sprinkler system, an adequate and proper design cannot be overemphasized. Information on proper design may be obtained from the dealer, Agricultural Extension Service, and Soil Conservation Service, the Bureau of Reclamation, and private irrigation engineers. With a properly designed sprinkler system, properly operated, you should produce as much or more crops than your neighbor regardless of his method of irrigation. ###

Water Report

Continued from page 103

precipitation has been deficient at valley elevations for several months. The soil is dry.

The water supply outlook for the Rio Grande and tributaries in Colorado is poor but better than for the very dry years of 1950 and 1951. Reservoir storage carried over from the high flows last year is above normal. Valley soil moisture is fair and groundwater for subirrigation is at high levels. Streamflow will range from 40 to 60 percent of normal.

West of the Continental Divide there will be some shortage of water on smaller streams and on the Dolores and San Juan tributaries. Colorado-Big Thompson Reservoirs may be used to partially regulate flow on the upper Colorado. Soil moisture conditions in irrigated areas in western Colorado are fair to good.

IDAHO—The snow pack over most of Idaho is normal or nearly so. The snow line, in general, is high and low altitude snow courses are generally slightly proportionately lower in snow cover than the courses higher in the mountains. Recent rain over the lower part of the river basins has partially erased the dry soil conditions found last fall before the snow began to accumulate. April–September streamflow is expected generally to be 95 percent normal. Reservoir storage for the State is 14 percent above average for this time of the year. Reservoir operators started to store water early in the winter, foreseeing this as the first year for more than five years when the water supply would be unlikely to exceed normal.

MONTANA—Snow cover on the upper Columbia Basin is good. At present, the Flathead Basin has about an average snow cover, while the Clarks Fork Basin is slightly above average. A good water supply for irrigation and other uses should result throughout the basin.

Snow cover east of the Continental Divide on the upper Missouri River Basin averages about 85 percent normal. The soil is not frozen under the snow, and the soil is generally dry to damp. Only in a few places was wet soil encountered on the watersheds.

Snow density is generally high for April 1st. The snow is loose and granular. These two factors indicate that an early runoff is possible with the dry soil absorbing considerable water for soil priming.

Farming operations in areas below reservoirs should have a good water supply for most of the season, while those areas using water from unregulated streams are likely to find themselves short of water for irrigation purposes during late July and August.

NEVADA—Snow stored water ranges from good in the central Sierra to fair in northeastern Nevada and poor in the central and southern part of the State.

United States Geological Survey reports October through March streamflow along the Humboldt and eastern Sierra above normal. Groundwater levels are reported as slightly below normal.

Reservoir storage on April 1 averaged 83 percent of capacity and 120 percent of the past 10-year average.

1953 snow-water runoff will be normal or below for all streams in the State. The southern half of Nevada can expect very little if any snow-water runoff. Along the Humboldt tributaries, streams can expect 50 to 75 percent of normal while the main stem will flow only about 30 percent normal. Runoff into Nevada from the east central Sierra will range from 70 percent normal in the south to normal in the north.

NEW MEXICO—The water supply outlook for the Rio Grande and its tributaries in New Mexico is for gravely deficient flow in 1953. The overall statewide water supply is likely to be the least in the past 25 years.

Soils in irrigated areas along the Rio Grande are very dry. El Vado Reservoir is empty in compliance with the Rio Grande compact and probably will not be able to store water this year. The irrigation supply for the middle Rio Grande irrigated area will be extremely limited.

Elephant Butte and Caballo Reservoirs now contain 420,000 acre-feet. This is four times that stored a year ago at this date. However, the total of storage plus expected inflow into the reservoirs will not exceed 60 to 70 percent of the normal irrigation water demand.

OKLAHOMA—The water supply outlook on the W. C. Austin project in Oklahoma is very poor at this time. The reservoir stores 17,600 acre-feet or 26 percent of capacity. There has been no inflow to the reservoir since June 1952. (NOTE.—This information is from Reg. 5, U. S. Bureau of Reclamation, Amarillo, Tex.)

OREGON—Oregon's 1953 water supply outlook dependent on mountain snow cover, is "fair" to "good" with serious deficiencies to be expected only in the smaller streams heading in low elevation watersheds. Water content of mountain snow cover averages 109 percent of normal statewide on 124 measured snow courses, although only 70 percent of last year at this date. Reservoired water in 25 reporting reservoirs is 120 percent of average and will "save the day" for water users in many areas otherwise facing irrigation deficiencies. Effects of last year's long summer and fall drought have been largely eased by heavy winter precipitation and resultant mountain snow cover. Cropland soils have an excellent moisture content.

SOUTH DAKOTA—Reservoir storage in the Black Hills area of South Dakota is down substantially from last year and about one-half of average. Snow cover is slightly above normal. Soil moisture conditions in irrigated areas are reported as fair to good.

UTAH—With the exception of a peculiarly narrow belt of normal runoff prospects running across the State from the Salina Creek-Fish Lake area to the La Sal mountain area near Moab, another small area in the Farmington-Bountiful vicinity and a strip draining into Wyoming from the high Uintahs, all other parts of the State can except below average runoff during this irrigation season.

In the southwest Utah runoff of the main and east forks of Sevier River above Piute Reservoir, the Escalante, Virgin, and Beaver Rivers and Coal Creek near Cedar City, will be of severe drought proportions comparable to that of 1951, with runoff expectancy varying from 20 to 45 percent of the 1941–50 average. Runoff prospects for the Beaver River is the poorest since 1934.

Prospective runoff for Strawberry and Whiterocks Rivers and Ashley Creek in the Uintah Basin, ranges from 50 to 60 percent average.

Runoff for all other streams of the State will range from 60 to 80 percent of the 10-year average. Very fortunately, holdover storage in 14 principal reservoirs now rests at 79 percent of capacity equaling 156 percent of the 10-year average. This means that water users in central and northern Utah, having storage rights, will have sufficient water during the irrigation season, whereas, water users depending solely upon natural flow rights can expect definite shortage of water.

WASHINGTON—Snow surveys on the headwaters of the Columbia River in Canada and other major contributing rivers in the United States indicate a lower than normal water supply for this season. The flow of the main stem of the Columbia is forecast for the lowest flow in 8 years if a normal spring melt season ensues. Water stored in smaller reservoirs (F D R excluded) is normal for this time of the year. New reservoirs, notably Hungry Horse, on the upper reaches of the main rivers will fortunately increase the water supply that can be used for power or irrigation during the normal low flow period.

WYOMING—Summer streamflow in most but not all of Wyoming is expected to be well below normal for the 1953 season. On the Green River the 1953 flow is forecast at 52 percent of normal, the least since 1940. Since

irrigation along the Green River is limited to mountain meadows local water supply should be adequate.

Although inflow to Seminoe Reservoir on the North Platte will be much less than normal in 1953, adequate irrigation water supplies in eastern Wyoming and western Nebraska are assured for this season. As a result of above normal flow the past few years there is now stored in the four major reservoirs along the North Platte in Wyoming 1,600,000 acre-feet. This is practically the same as a year ago but well above the average. The reservoirs were nearly at capacity at the end of the 1952 snow melt season but were reduced substantially because of high irrigation water demands in the summer months of 1952.

On the Laramie River and other smaller North Platte tributaries irrigation water shortages may be expected because carryover storage is not available.

The 1953 snow pack over the Wind-Big Horn River Basins averages 75 to 80 percent of average.

Those areas operating under reservoir-regulated streams should have a fair water supply for this coming season, but farm areas depending for water upon unreservoired streams can expect late season shortages.

Water users in Western Wyoming along the Snake and its tributaries are assured of an average water supply although reservoir storage is 6 percent below normal.

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Rotation Grazing

by LITER SPENCE, Range Specialist, University of Idaho Extension Service

Rotation grazing pays for its fences, and then some. The rotation idea requires that the pasture be divided into 3 or 4 fields. Stock are permitted on one section at a time. The other areas put on fresh growth. The use of a number of pastures, rather than one, as in old-style conventional grazing, calls for more fencing and watering places. However, the increased returns, particularly where alfalfa or ladino clover make up an important part of the pasture mixture, will more than justify increased cost of fencing. Electric fences can be used to advantage.

Top growth of forage determines the root growth, for without the top there can be no plant food production to feed the root systems and increase top growth. A simple guide to good management is the stubble height or the closeness of grazing that is allowed. It is just as easy to maintain a six to eight inch stubble on a healthy pasture as it is to maintain one inch of stubble on a poor pasture. More forage will be produced by maintaining high stubble than where a pasture is grazed to the ground. This also provides an insurance factor, for if for some reason the pasture becomes short, this high stubble can be used in an emergency. Such a practice will set the growth back temporarily, but it is not permanent. Repeated close cropping will result in permanent injury.

#

"WATER IN THE WEST" HONORED

Assistant Secretary of the Interior Fred G. Aandahl (right) congratulates Ben Glaha, Chief Photographer, Reclamation Region 2, Sacramento, upon the Department's receipt of a certificate from the Edinburgh Film Festival for Reclamation's film, "Water in the West." Glaha, holder of many honors, including the Interior Department's Distinguished Service Award, for his outstanding photography of Reclamation works over two decades, made the motion picture.

The certificate was presented to Mr. Aandahl, who received it on behalf of the Department, by Sir Roger Makins, British Ambassador, at a ceremony in the Interior Auditorium on March 27.

The Edinburgh Film Festival is held annually to inspire world progress in the film arts. Each country is invited to send its best motion pictures. "Water in the West" was chosen one of the outstanding documentary films of the year for showing at the festival to an international audience. •

Editor Sadler Resigns

Ruth F. Sadler, who has been editing the Reclamation Era since 1946, has resigned effective at the close of business March 12. She is accompanying her husband, George E. Sadler, to Rio de Janeiro, Brazil, where he has accepted an assignment with the Institute of Inter-American Affairs.

J. J. McCarthy will be your Acting Editor for the time being. •

NOTES FOR CONTRACTORS

Contracts Awarded During March 1953

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DC-3825	Boise, Idaho	March 12	Alterations to Arrowrock Dam	Quinn-Robbins Co., Inc., Boise, Idaho.	$108,31
DS-3855	Gila, Ariz	March 17	Five 4,160-volt synchronous motors for Wellton-Mohawk pumping plants Nos. 1, 2, and 3.	Electric Products Co., Cleveland, Ohio.	187,26
DC-3860	Vermejo, N. Mex	March 4	Construction of dams and dike for reservoir rehabilitation.	Colorado Constructors, Inc., Denver, Colo.	850,21
DC-3863	Grants Pass, Oreg	March 9	Rehabilitation of Savage Rapids Dam	Young and Smith Construction Co., Salt Lake City, Utah.	343,85
DC-3869	Missouri River Basin, Nebr	March 12	Remodeling and initial construction for Kansas River District headquarters office building at McCook, Nebr., schedules 1 and 3.	Korshoj Construction Co., Inc., Blair, Nebr.	141,59
DC-3869	do	March 13	Remodeling and initial construction for Kansas River District headquarters warehouse at McCook, Nebr., schedule 2.	Robert E. Phillips Co., McCook, Nebr.	15,13
DC-3871	Boulder Canyon, Ariz.-Nev.-Calif.	March 9	Construction of earthwork, pipelines, and structures for laterals 116.1 and 118 and sublaterals, part 1 of unit 8, Coachella Valley distribution system, All-American Canal system.	R. V. Lloyd and Co., Coachella, Calif.	467,23
DC-3872	do	March 11	Construction of earthwork and structures for equalizing reservoir near Coachella canal, All-American canal system.	Robert E. L. Parker Co., Claremont, Calif.	31,77
DS-3874	Missouri River Basin, Mont	March 10	62,000 barrels of bulk portland cement for Tiber Dam	Ideal Cement Co., Denver, Colo.	238,70
DC-3877	Columbia Basin, Wash	March 27	Construction of earthwork and structures for East Low canal and Scooteney wasteway.	J. A. Terteling and Sons, Inc., Boise, Idaho.	2,904,23
DC-3878	Davis Dam, Ariz.-Nev	March 19	Additions to Cochise and Phoenix substations	Howard P. Foley Co., Salt Lake City, Utah.	57,23
DC-3880	Central Valley, Calif	March 13	Construction of earthwork, concrete pipelines, and structures for laterals 6.2, 7.1, and 7.3, Contra Costa County Water District, Contra Costa canal distribution system, schedule 1.	Coast Pipeline Contractors, Belmont, Calif.	305,48
DC-3880	do	do	Construction of earthwork, concrete pipelines, and structures for lateral 9.1, Contra Costa County Water District, Contra Costa canal distribution system, schedule 2.	Kevry Construction, Inc., San Leandro, Calif.	71,37
DC-3883	Missouri River Basin, S. Dak	March 31	Additions and modifications to Huron, Mount Vernon, Sioux Falls, and Watertown substations for 115-kv operation.	Electrical Builders Assoc., Mayville ,N. Dak.;	179,69
DC-3892	Missouri River, S. Dak	March 27	Stringing conductors and overhead ground wires for 122 miles of Fort Randall-Sioux City 230-kv transmission line.	Campsey-Lytle-Richards, Denver, Colo.	925,14
117C-182	Columbia Basin, Wash	March 25	Babcock pump wastewater disposal system	Otis Williams and Co., Kennewiek, Wash.	37,20
117C-183	do	March 9	Chute and stilling pool repair, Rocky Coulee wasteway, Station 1+18 to Station 14+97.	L. D. Shilling Co., Inc., Moses Lake, Wash.	34,28
617C-32	Riverton, Wyo	March 2	Buried asphaltic membrane lining for Wyoming Canal, Station 1709 to Station 1738 and Station 1865 to Station 1870.	Studer Construction Co., Billings, Mont.	26,82
617C-33	do	March 19	Channel relocation and erosion control works along Five Mile Creek.	Lichty Construction Co., Riverton, Wyo.	113,27
601C-30	Shoshone, Wyo	March 24	Buried asphaltic membrane lining for laterals R-4-S, Station 76+45 to Station 148+24.7.	Taggart Construction Co., Cody, Wyo.	17,46
601C-31	do	March 26	Closed drains	Hicks Construction Co., Riverton, Wyo.	19,07

Construction and Materials for Which Bids Will Be Requested by July 1953

Project	Description of work or material
Boise, Idaho	Relocation and construction of community facilities at Arrowrock dam near Boise, Idaho.
Cachuma, Calif	Construction of Goleta distribution system laterals Nos. 10 to 16, and pumping plant in lateral area 13-1, along U. S. Highway 101, between Goleta and Santa Barbara, Calif., requires furnishing and laying about 12 miles of 2- to 14-inch diameter steel pipe and constructing a plant to house one 100-gpm and three 200-gpm pumps at 225-foot head, and install 1 pump of each size. The plant will have a steel air chamber with compressor for equalizing line pressures.
Central Valley, Calif.	Furnishing and erecting prefabricated metal buildings at Tracy pumping plant, near Tracy, Calif., as follows: one each 40- by 40-foot, 20- by 100-foot, and 40- by 100-foot; and 20- by 140-foot and 40- by 100-foot car stalls, with concrete foundations and concrete floor slabs or asphalt pavement floors. Electrical wiring, water and sewer lines, and electrical heat and evaporative coolers in garage also included.
Do	Installing new oil lines for Tracy switchyard.
Do	Constructing roads and providing drainage for Tracy switchyard.
Central Valley, Calif.—Continued	Construction of 11 miles of 12- to 30-inch concrete pipe lines, including 12 gravity turnouts and 12 turnouts with pumping plants of 9 to 2 cfs capacities for the Plainview Water Irrigation District distribution system on the Delta-Mendota canal, about 5 miles south west of Tracy, Calif.
Do	Installation of a Government furnished 100-cfs pump unit and several flap gates in each of pumping plants Nos. 1, 2, 3, and 4 on the Contra Costa canal between Antioch and Martinez, Calif.
Do	Construction of 58 miles of 12- to 66-inch diameter reinforced concrete pipe line, monolithic concrete mos screens, and low-head pumping plants, valves, slide gates, miscellaneous metalwork, and electrical control for Unit 1 of Delano-Earlimart Irrigation District distribution system, Friant-Kern canal, located in Tulare county near Earlimart, Calif.
Columbia Basin, Wash.	Construction of office building, general purpose shop storehouse, and a 10-car garage for Royal Watermaster headquarters. Office is to be of brick veneer and other buildings of concrete block.
Do	Drilling water supply wells for ditchriders' sites in lateral areas W-6A and W-8 near Quincy, Wash., and two wells in area E-4 near Warden, Wash.

Construction and Materials for Which Bids Will Be Requested by July 1953—Continued

Project	Description of work or material
Columbia Basin, Wash.—Continued	Moving 6 two-bedroom temporary houses from present government camps to new locations near Quincy and Warden, Wash., and remodeling into two-bedroom houses with basements. Also included is construction of garages, pump houses, streets, and installation of utilities.
Do	Grading and paving 1,000 feet of access roadway in industrial area, and clean up of former compressor house area at Grand Coulee Dam.
Do	Construction of area W-6B laterals, sublaterals, and wasteways, varying from 90 to 2 cfs capacities on West canal near Quincy, Wash.
Gila, Ariz	Construction of 2.4 miles of 220-cfs Dome canal and 2.6 miles of 100-cfs lateral D-1.4E, near Dome, Ariz. Structures on Dome canal include river siphon, road siphon, radial gate check, three bridges, and turnouts.
Do	Construction of 28 miles of concrete-lined canal and laterals of 220 to 15 cfs capacities, 7 pumping plants of 80 to 15 cfs capacities, Unit 1 of Dome canal and distribution system, about 10 miles east of Yuma, Ariz.
Do	Vertical-shaft, motor-driven, propeller-type pumping units having the following capacities: three units each of 26.7 cfs at 21.5-foot head; four units of 15 cfs at 10-foot head; one unit of 15 cfs at 15-foot head; three units of 15 cfs at 7-foot head; and one unit of 15 cfs at 4-foot head, all for Dome distribution system.
Minidoka, Idaho	Drilling and casing 20 irrigation wells for North Side pumping division, near Rupert, Idaho.
Do	Construction of laterals from 20 irrigation wells for North Side pumping division.
Missouri River Basin, Iowa.	Construction of 66,667-kva Sioux City substation near Sioux City, Iowa, will involve furnishing and erecting steel structures and a 42- by 62-foot masonry control building and installing government furnished electrical equipment.
Do	Main control board, distribution boards, and battery chargers for Sioux City substation
Missouri River Basin, Mont.	Construction of Missouri diversion dam, 4 miles southwest of Frazer, Mont., is to comprise 2.3 miles of earth dike embankment across the Missouri River, a 40-foot high gated concrete overflow section for seven 80- by 6-foot crest gates, and 350 feet of concrete retaining walls 35 to 60 feet high. The earth dike is to be 25 feet high for 11,000 feet and 45 feet high for 1,000 feet. The 3-unit, 18,000-kw Little Porcupine power plant will have a reinforced concrete substructure 103 by 188 feet and 70 feet high; and a government-furnished steel superstructure 57 by 188 feet and 45 feet high, with insulated steel panel walls. The upstream portion of the power plant structure is designed to act as a gravity dam against the reservoir. The contractor will construct concrete spiral casings and install embedded parts of three turbines, each 8,400 horsepower at 30-foot head, and install traveling cranes. Also included are headworks structures for Missouri and South Side canals.
Missouri River Basin, Nebr.-Kansas.	Construction of 11 miles of unlined Naponee canal, laterals, drains, and appurtenant reinforced concrete structures will require 200,000 cubic yards of excavation and about 8,000 feet of 18- to 28-inch diameter concrete pipe, capacity ranging from 36 to 6 cfs. Work is on south side of Republican River beginning at Harlan County Dam, 12 miles west of Franklin, Nebr.
Do	Construction of 18 miles of unlined laterals varying from 12 to 6 cfs capacities with appurtenant reinforced concrete structures for Franklin canal's first section, near Franklin, Nebr.
Missouri River Basin, N. Dak.	120,000 pounds of fabricated galvanized structural steel for bolted structure additions to Bismarck substation.
Provo, Utah	Placing earth lining on a 0.5-mile reach of existing 1,000-cfs Weber-Provo diversion canal, 3 miles north of Kamas, Utah.
Rio Grande, N. Mex	Furnishing material and stringing 2 galvanized steel overhead ground wires on 360 miles of existing 115-kv transmission lines.
Vermejo, N. Mex	Rehabilitation of Vermejo diversion dam, 11 miles of 600-cfs Vermejo canal, and 24 miles of 300-cfs Eagle Tail canal, 8 miles northwest of Maxwell, N. Mex., including revising the diversion dam headworks structure, enlarging the outlet structure to 450 cfs capacity, and installing nine slide gates.
Yakima, Wash	The combined Chandler power and pumping plant to be constructed on the Yakima River about 9 miles downstream from Prosser, Wash., will consist of a 12,000-kw power plant to house two 6,315-kva generators, and a 500-cfs capacity turbine-driven pumping plant to house an initial two and an ultimate three 167-cfs units. The headworks consist of a gated ogeway 20 by 3 feet, four siphon spillways discharging into a 1,500-cfs, 390-foot long spillway chute; a 4-foot diameter sluice gate, a trashrack structure at entrance to two 120-inch power penstocks, and three 87-inch pump supply lines. The contractor will construct a 3,500-foot long, 99-inch diameter, 250-foot-head pump discharge line across the Yakima River to the Main canal and furnish either steel pipe or concrete pipe, steel-lined for 2,300 feet. He will install embedded parts of two 8,500-hp and two 2,600-hp government-furnished turbines and a 30-ton bridge crane; and construct a railroad bridge and highway bridge.

United States Department of the Interior, Douglas McKay, Secretary
BUREAU OF RECLAMATION OFFICES AS OF APRIL 15, 1953

Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

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Assistant Commissioner—Kenneth Markwell
Assistant Commissioner—Harvey F. McPhail
Assistant to the Commissioner—Engineering—T. W. Mermel
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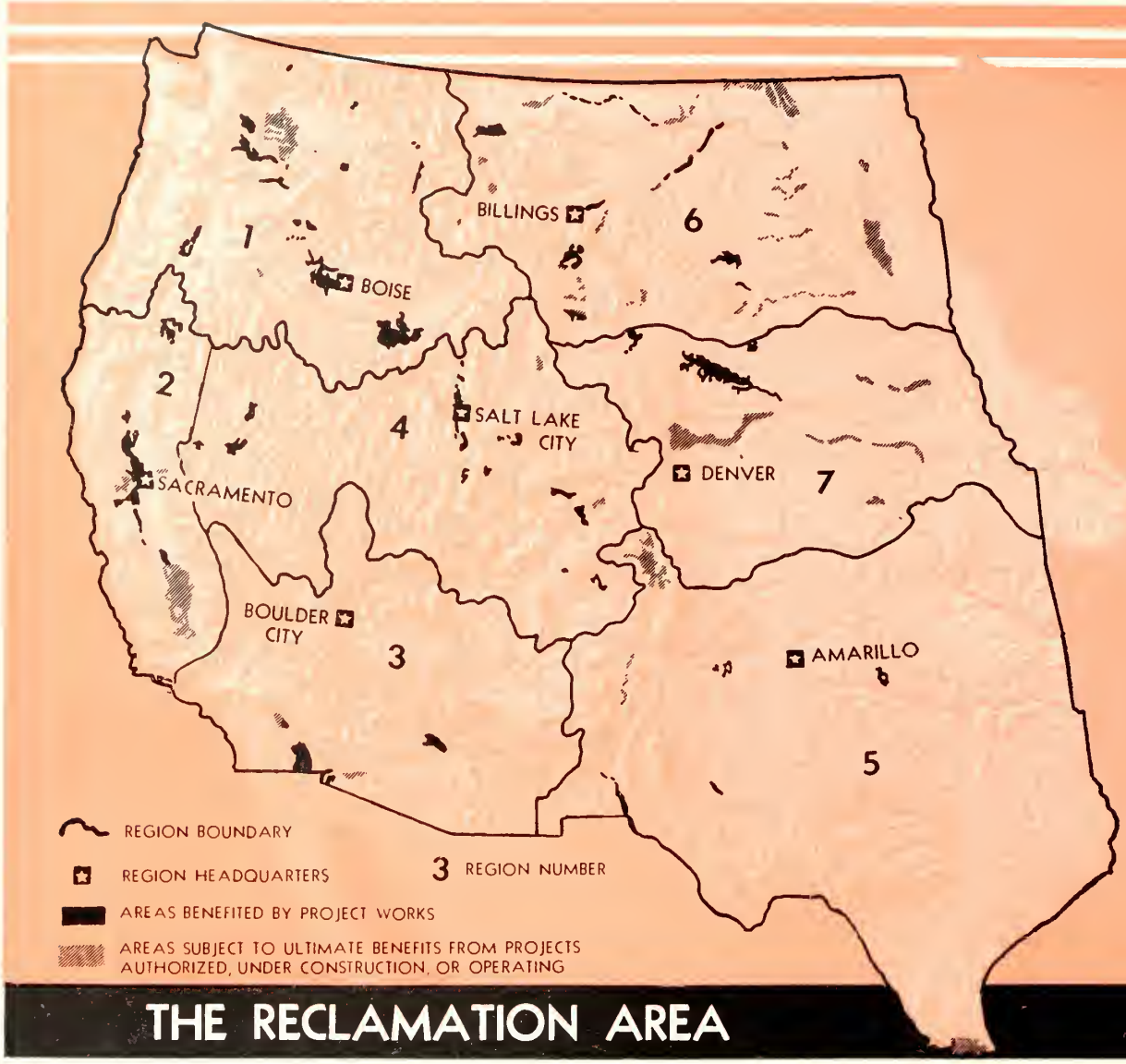
District Manager, Alaska District Office, Juneau, Alaska—Joseph M. Morgan

REGIONAL OFFICES

REGION 1: Harold T. Nelson, Regional Director, Box 937, Reclamation Building, Fairgrounds, Boise, Idaho
REGION 2: R. L. Boke, Regional Director, Box 2511, Fulton and Marconi Avenues, Sacramento 11, Calif.
REGION 3: E. G. Nielsen, Regional Director, Administration Building, Boulder City, Nev.
REGION 4: E. O. Larson, Regional Director, 32 Exchange Place, P. O. Box 360, Salt Lake City 10, Utah.
REGION 5: H. E. Robbins, Regional Director, P. O. Box 1609, Old Post Office Building, 7th and Taylor, Amarillo, Tex.
REGION 6: K. F. Vernon, Regional Director, 7th and Central, P. O. Box 2130, Billings, Mont.
REGION 7: Avery A. Batson, Regional Director, Building 46, Denver Federal Center, Denver, Colo.

Water--is Wealth

U. S. GOVERNMENT PRINTING OFFICE: 1953



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The Reclamation Era

Official Publication of the Bureau of Reclamation

June

1953

IN THIS ISSUE

June 1953

Volume 39, No. 6

The Reclamation ERA

25 Years Ago In The Era

The preservation of the farming business on a basis which will maintain on the land a rural population that may continue to contribute to the public welfare something more than an adequate food supply is essential to the permanent well-being of this country. (From the inside front cover of the June 1928 issue of the New Reclamation Era, predecessor to the RECLAMATION ERA.)

OUR FRONT COVER—SPRING PLANTING ON THE MINIDOKA PROJECT.—Homesteader Eugene C. Wilbur loads a drill with peas which are being grown for eventual use by a frozen food company. Mr. R. B. Wilbur, his father, waits for the task to be completed so that he may resume planting. *Photo by Stan Rasmussen, Region 1.*

OUR BACK COVER is based upon a photograph of a relief model of the United States and reproduced with the permission of the copyright owners Kittredge and Coolidge.

DESIGN AND ILLUSTRATIONS by Graphics Section, Bureau of Reclamation, Washington, D. C.

J. J. McCarthy, Acting Editor

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Water is Wealth

In this issue . . .

RECLAMATION PLACE NAMES IN THIS ISSUE

PROVO RIVER FISHING RENEWED.—1. Cascades in river formed by large boulders furnish ideal resting places, feeding pockets, and shade for large trout. 2. Rock barrier in main channel of river forms succession of terraced pools ideal for dry fly fishing during low water. 3. Rock barrier across river provides pool for trout. 4. Fishing for brown and rainbow trout on Deer Creek Reservoir. *Photos 1 and 4 by the author; 2 and 3 by F. H. Anderson, Region 4.*

PROVO RIVER REHABILITATED

by HACK MILLER
Fishing Editor, Deseret News

EDITOR'S NOTE: We are indebted to Mr. Hack Miller, Fishing Editor of the Deseret News, for the following article which appeared as his column "Rod and Gun" in the March 21 edition of the News. A brief description of the Provo River project and its purpose has been inserted in Mr. Miller's original article for the information of our readers.

Several years ago when the Bureau of Reclamation moved in on the Provo River in Utah and dredged it into a gutter-like cobblerock canal we moved in with a barrel of criticism. We figured, like all the other fishermen, that one of the State's finest waters had been ruined.

We were right, it had.

Why did the Bureau of Reclamation take this step? Because, it was necessary to build the Provo River project which would provide supplemental irrigation water for 46,000 acres of inadequately watered land in the Utah and Salt Lake Valleys, as well as furnish industrial and municipal water supplies to meet Salt Lake City's needs via the Salt Lake aqueduct. If the project had not been built, unless additional water supplies were developed to meet growing urban requirements, municipalities would be forced to take water from irrigated farms (exercising their preferential right to condemn irrigation water for municipal use).

Just to see what the river was like and what its future was going to be we joined with several experts from the bureau and went over the com-

BANK FISHING near Charleston Bridge across the Provo River at the upper reaches of Deer Creek Reservoir. Lucky anglers occasionally land large trout. ***Photo by the author.***

plete dredged area last March. And it took most of a day.

Herewith we present the report of that trip and our own observations on what we think will eventually be the fishing fate of this fine stream.

We went afield with L. R. Dunkley of Provo, chief engineer on the project. With him were Claude Sherry, Mack Corbett, and Harold Anderson—all from the Bureau of Reclamation offices in Salt Lake and Provo.

The Bureau has just completed a riprapping project which has called for the hauling of 47,000 tons of large rocks to guard the shoreline of the river bed. Last season the river broke through in several spots. This year it won't be able to.

And in the process the Bureau, where it has been able to do it, has put some 5-ton boulders in the stream bed to make a home for the fish.

Shoreline Changes Made

The new shoreline made by the Bureau will have a tremendous effect in stabilizing the fishing. For several years now the fish have been without cover. An 8-inch cobblerock was about the biggest obstacle in the course.

It isn't so now. Fish can shade under the side rocks, find habitat in the deep holes and even live in the many cascades.

The work done by the Bureau isn't a fisherman's dream by any means. But it's a long step toward a solution. Along the right-of-way the natural trees and grasses are gone. Big stumps are being derricked from the river course so they won't take out the bridges during flood water. All these would help make fishing cover.

Fish Need Shade and Cover

We've found in our many years of fishing that fish require shade. Sometimes they get it in the currents, under the mosses, along the willow banks, or siding against a large boulder. They can't stand the sun any better than us humans. If they don't have shade they won't stay around. You can bet on that.

Mr. Dunkley tells us that the Bureau is just about through in limited areas. But the big work is finished. The stream will soon be left alone.

Where the stream has had a chance it has begun to grow its mosses and water weeds. The growth has been good. Give it a couple of years and it

will come back nicely: It will never be the old Provo River. That is as certain as apples. But with a little time, nature will do her best.

Bureau Men Are Fishermen

E. O. Larson, regional director for the Bureau, is an ardent fisherman. So's Dunkley, Corbett, and others. They had a contract to supply water. Yet they didn't want to spoil the fishing.

They got one job done at the expense of the other and in the process, consistent with their engineering requirements, they have thoughts of the fisherman wherever possible. The improvements shown on the river during the past year have left little doubt about this.

The Bureau is anxious to leave the river alone now. There are still a few bottlenecks. These are minor, however.

Throughout most of the dredged area the river is making winding channels and creating some pretty suitable fishing holes. This is an improvement to say the least.

The future of the river depends on how badly it is tinkered with. If the bulldozers and draglines are kept ont of the riverbed we'll have a fair fishing stream. If they are not, we'll have nothing more than a millrace. ###

NRA Board Members Confer With Interior Officials

Members of the Board of Directors, National Reclamation Association confer with Secretary of the Interior, Douglas McKay, and his staff at the Interior Department, on April 7, 1953.

Seated (left to right) are: LaSelle E. Coles, Oregon Director; Arthur Svendby, South Dakota Director; Fred G. Aandahl, Assistant Secretary of the Interior, Water and Power; Ralph A. Tudor, Under Secretary of Interior; Douglas McKay, Secretary of the Interior; C. Petrus Peterson, President, N. R. A., and Nebraska Director; A. N. Smith, Nevada Director; Dr. E. Porter Ahrens, for Paul Applegate, Kansas Director; H. H. Moeur, Arizona Director; Charles L. Kaupke, California Director. Standing (left to right) are: Frank Raab, Oklahoma Director; Harry E. Polk, North Dakota Director; E. R. Wells, Washington State Director; Earl T. Bower, Wyoming Director; N. V. Sharp, Idaho Director; William E. Welsh, Secretary-Manager, Washington, D. C.; Herbert L. Buck, Treasurer and Montana Director; D. D. Harris, Utah Director; J. E. Sturrock, Texas Director; Harold H. Christy, Colorado Director; and Lyman B. Horton, Railroad Representative. •

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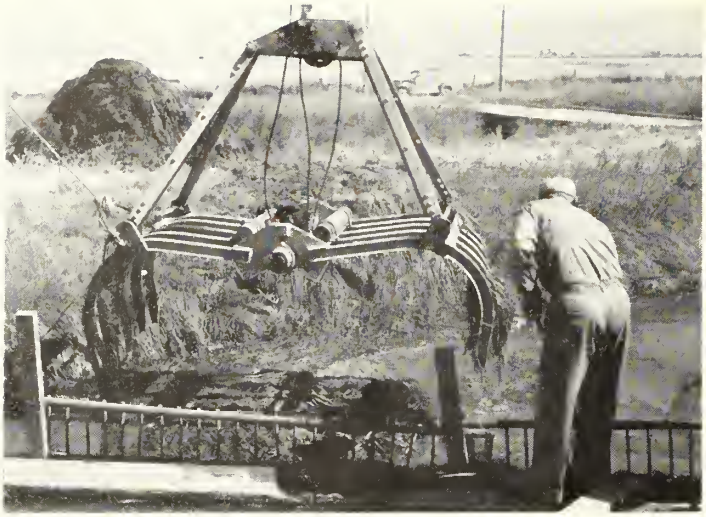


"MOSS FORK" in a close-up just before it is dropped into the water. At right, truck dragline in operation lifting weeds from lateral as they float into homemade guide. The trap in these photos is the one previously used. *Photos by A. M. Bergloff, Region 2.*

KLAMATH'S "MOSS FORK AND TRAPS"

by E. C. CAKIN, Agriculturist
Klamath Project, Oregon-California

An extensive system of open drains which is essential to the reclamation of 190,000 acres of irrigated land of the Klamath project totals over 500 miles in length, and is weed infested more than usual because of the large amount of water carried and the flat gradients and slow current. Nearly all the drain discharges are evacuated by pumps of various sizes—over 30 in number.

The types of water plants most prevalent: Sago pond weed (Potamogeton Pectinatus), Richardson pond weed (Potamogeton Richardsonii), Coontail (Ceratophyllus demersum), and common waterweeds (Anacharis Canadensis).

Keeping the drains open is a major problem. Several methods of control are in general use—aromatic solvents, chaining, and dredging. The removal of the dislodged weeds that have floated downstream to the pumps or to culverts and siphons has in past years been done to quite an extent by hand labor at a relatively high cost. The savings therefore due to the use of the device and system here described has been very gratifying and it is believed is worth the consideration for other projects with like problems.

For many years the pulling of moss from ditches was done with the hand fork, requiring up to 30 laborers each season. Except for the smaller laterals, where aromatic solvents are used, chaining for moss control is still prevalent. In an attempt to reduce the manpower used in this work, Luther McAnulty, irrigation manager of the Tule Lake Division of the Klamath project, purchased a crane-operated Blaw-Knox sugarcane grapple or fork. This fork was modified by adding two prongs and a heavy weight to each jaw. The weights were needed to give faster and more positive action in opening and closing. This fork was worked by a truck crane, giving it the required mobility to move around to various ditches as required.

Following the adaptation and successful use of the "moss fork," as it is locally termed, it became evident that a better method of ponding the moss for the truck crane would be needed than to let it pile up at structures. Floating booms, mesh fencing, trash racks patterned after pumping plant grates, and other methods and devices were tried out.

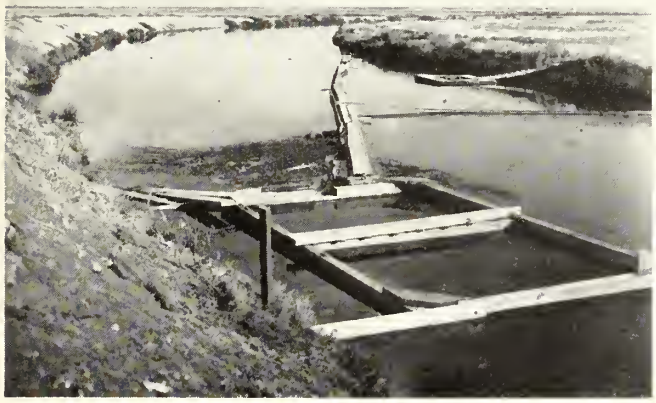
The most successful one, locally termed a "moss trap," consists of two 30-foot power or telephone

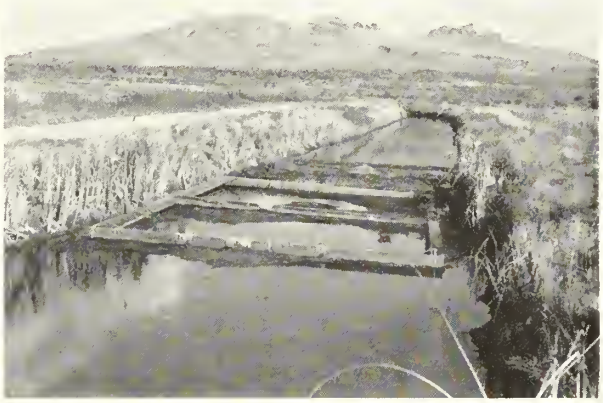
poles or large timbers placed parallel to each other and three 4 by 12-inch timbers bolted crosswise, one at each end and the third in the middle, thus forming two stilling ponds. The length of the 4 by 12-inch cross timbers depends on the width of the ditch. These traps are placed in the ditch at points readily accessible to the truck crane and are held in place by cables.

As the pond weeds are torn loose by chaining and float downstream, they lodge against the upstream cross timber of the trap. Some are forced under and lodge against the middle cross timber. Very little moss is found in the second stilling pond of the trap. The blanket of moss lodged against the trap has been a quarter of a mile long without seriously impeding the flow of water. When sufficient moss has been ponded the truck crane comes along and removes it with the moss fork. These traps are left in place throughout the year.

Annual savings to the project from the use of the moss fork and moss traps have been estimated to be about 10,000 man-hours of unskilled labor since only two men, crane operator and oiler, are required for the truck crane. The original cost of the moss fork purchased in 1950 was $653. The estimated cost for construction of each moss trap was $140. Twelve of these traps were placed in operation in 1952, each one more than paying for itself in savings of man power during the first irrigation season. ###

FLOATING LOG BOOM (lower left) directs weeds into trap and is used in wide channels. In channels, same with as trap (below), log boom is not necessary. *Photos by M. D. Taylor, Jr., Region 2.*





Western Society of Soil Science Schedules Annual Meetings

The annual meetings of the Western Society of Soil Science are to be held at Santa Barbara, Calif., from June 15 to 17, inclusive, in conjunction with the meetings of the Pacific Division of the American Association for the Advancement of Science. The program includes an all-day field trip on June 15 to study the soils of the area; a general session on Tuesday morning, June 16, with an afternoon symposium on soil structure. Wednesday, the 17th, will be shared in a joint discussion with the American Society of Horticultural Sciences, followed by a general session of contributed papers in the afternoon. The annual banquet and business meeting will be held Wednesday evening, with Dr. L. A. Richards of the United States Salinity Laboratory, Riverside, Calif., as speaker. The papers on Thursday will deal largely on soil fertility problems with the possibility of additional talks on "Characterization and Reclamation of Alkaline and/or Saline Soils", "chlorosis," and "minor elements."

The society's officers are Maurice N. Langley, president; Dr. D. W. Thorne, Department of Agronomy, Utah State College, Logan, Utah, vice president; and Dr. Robert M. Hagan, Department of Irrigation, University of California, Davis, Calif., secretary-treasurer.

A condensation of papers presented at the annual banquet at Corvallis, Oreg., last year entitled "Nitrogen in the West" was carried in both the April and May issues of the RECLAMATION ERA this year.

The society was incorrectly referred to in the April issue as the Western Soil Science Society instead of the Western Society of Soil Science.—Ed. #

RECLAMATION'S HALL OF FAME

Nomination No. 17

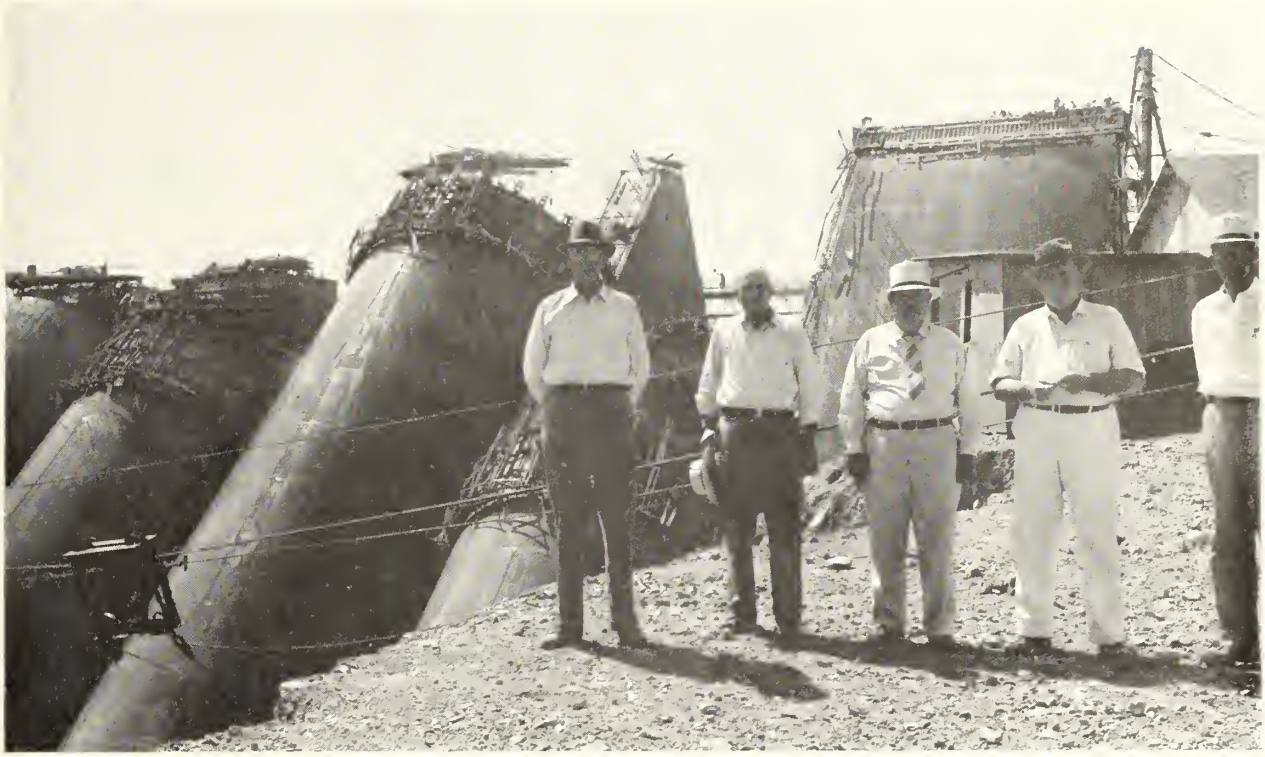
LIN B. ORME

by WILLIAM J. WILLIAMS, Boulder City, Nevada, Region 3

Reclamation was as right as rain in the eyes of Lin B. Orme. And down in the Salt River Valley of Arizona during the long droughts when farmers despaired, Orme would lift their spirits with his famous assertion: "It will rain—it always has. All you've got to do is have faith."

Lin B. Orme had faith not only in the weather but in Reclamation. He was among the army of pioneer Westerners who fought for the Reclamation Act, passed in 1902. And long before the act was passed, he envisioned the Salt River Valley made great by a regulated water supply from Reclamation dams on the Salt and other rivers in the area.

He was one of the original incorporators of the Salt River Valley Water Users' Association in 1903. In the succeeding years until his retirement in 1948, he held every elective office in the Association, the agency which contracted with the Federal Government to repay the cost of Roosevelt Dam and other irrigation works to serve the valley. He was a member of the board of governors, was vice president from 1932 to 1934, and was president from 1934 until his retirement. He held the distinction of being the only president to be reelected without opposition. During his administration Bartlett and Horseshoe Dams, representing an investment of $10 million and an added water storage capacity of over 320,000 acre-feet, were constructed on the Verde River.



Bartlett Dam on the Verde River near Phoenix, Ariz., shown here under construction, was built during Lin B. Orme's administration as president of the Salt River Valley Water Users' Association.

Orme (wearing tie) is shown here at dam site on September 22, 1938, with Bureau of Reclamation engineers and Association members.

Orme's uncle, John P. Orme, was president of the Association from 1910 to 1918. And carrying on in the family tradition of serving the West's natural resources interests, his nephew, Orme Lewis, is at present Assistant Secretary of the Interior.

Orme was born in Springfield, Mo., in October 1872, and with his parents moved to the Salt River Valley 7 years later. When death came to him at the age of 80 last March 26, he was still maintaining his home on the fertile 160-acre farm 8 miles west of Phoenix where he had lived since 1897. His son, Lin H. Orme, is a prominent attorney in Phoenix.

This writer spent an afternoon with Orme, recently, at his comfortable old-fashioned home. Surrounded by beautiful trees and flower gardens, the home revealed his artistry and good taste as well as those of Mrs. Orme, who passed away 4 years ago. Amid stacks of old pictures and newspaper clippings, the writer and this great pioneer traced the history of the Salt River Valley, so similar to that of other Western Reclamation areas. There were the good and bad years—the droughts and the floods. And then came the dams with their familiar results.

Orme was proud of his reputation as the valley's foremost rain prophet. In the summer of 1951, when the reservoirs behind Roosevelt and other project dams were almost dry, and when irrigators were wondering where the next drop of rain was coming from, Orme forecast rain. He went on the theory that the valley had a wet cycle every 10 years. And sure enough, in August that year the heavens opened up on the watershed and put water in the reservoirs to save thousands of acres of crops that otherwise would have perished.

One of Orme's proudest possessions was a colored picture of water spilling over Roosevelt Dam, which hung on his dining room wall. The picture was presented to him in 1941 by valley residents who were elated that Orme's rain forecast that year had come true. The picture was mounted in a large frame behind glass and across the top was printed this declaration: "It will rain, it always has."—Lin B. Orme. ###

LIGHT, FREQUENT IRRIGATION, providing fairly constant moisture to soil, can bring about top water efficiency and higher quality potatoes. *Photo by Phil Merritt, Region 1.*

LIGHT, FREQUENT IRRIGATION BEST

by GILBERT L. COREY, Assistant Irrigationist
University of Idaho Agricultural Experiment Station

Idaho Study Indicates That Keeping Soil Moisture Up Boosts Both Yield and Quality of Potatoes

Watch moisture in the soil—not the calendar—for the signal on when to irrigate. When you do, you will irrigate lightly and frequently, which is the way to get most value from the water. That was one of the important recommendations coming out of a 2-year study at the University of Idaho's Aberdeen Branch Station, in the heart of one of the State's major commercial potato-producing areas.

The objective of these studies was to determine what irrigation practice would produce the greatest yield of high-quality potatoes. Potatoes grown were Russet Burbank, Idaho's principal variety. One set of treatments (plots) was irrigated when available moisture was 30 percent depleted, another when it was 70 percent depleted, another when it was 85 percent depleted, while a fourth set was allowed to dry out until the plants showed marked visible moisture stress. Both sprinkler and furrow irrigation methods were compared.

Here is the general roundup of recommendations coming out of this study:

1. Do not wait too long after planting before the first irrigation. In general, this irrigation should come before the plants are 30 days old. The experiment shows no harmful effects by a little over-irrigation at this time, while insufficient irrigation early in the season causes a reduction in yield and quality.

2. Irrigate the crop frequently with light applications during the hottest part of the season to keep the soil cooler. Light applications are advised because no benefits were shown by irrigating with heavy applications. Heavy applications show only a waste of water.

3. Tubers with constrictions are formed during the hot part of the summer. If the soil is kept cool and at a uniform moisture, good quality tubers will result.

4. The potatoes need not be irrigated as often in August after the days have become shorter and cooler.

The penalty for delaying irrigation until the soil moisture was 70 percent gone in the top 10 inches of the soil was particularly severe. The 2 years of data collected at Aberdeen indicate the grower can expect any or all of the following unfavorable developments by such irrigation:

PLEASE TURN TO PAGE 127

CONSTRUCTION BEGUN ON VERMEJO PROJECT

Sixty-five years after the first attempt at irrigation by private capital the farmers of Colfax County, N. Mex., near the village of Maxwell, have a new Federal reclamation project underway. It is the Vermejo project.

The Colfax pioneers in 1888 built an irrigation system which they hoped would be capable of supplying water to 15,000 acres of land. Over the years it developed that the works were capable of serving only 3,500 acres, and that the water supply for this acreage was inadequate. The storage capacity loss in the reservoir was caused by sedimentation. In addition to this problem there was general deterioration of the distribution system as well as the control structures. Because the water supply was so short of the amount anticipated, farmers could no longer make a living from agriculture. They had to seek other employment, often far from home.

Determined to save their community, the people of Colfax appealed to their leaders in Congress The Congress requested the Bureau of Reclamation to find out what, if any, help the farmers could get in the way of repairing the irrigation works, under the reclamation law.

Bureau of Reclamation engineers made an investigation of conditions in the area and submitted their report to the Congress. The Congress in turn authorized the Vermejo project by the act of September 27, 1950, as amended by the act of March 5, 1952.

Under the terms of the repayment contract between the United States and the Vermejo Conservancy District the farmers will repay the costs of rebuilding their project. The project plan, as authorized by Congress, provides for enlarging and repairing three reservoirs, and repairing an existing diversion dam, canals, laterals, and drains. These facilities will provide a safe irrigation water supply for 7,200 acres, 3,500 of which were previously receiving a short supply of water.

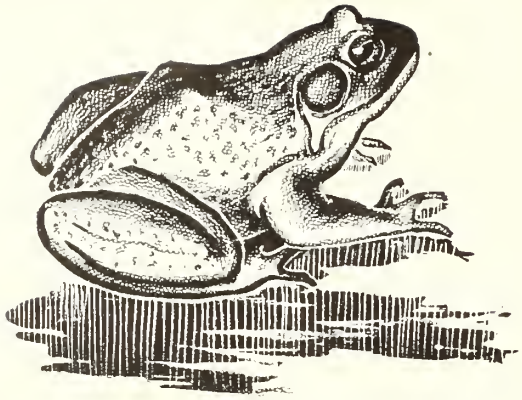
Early last April the people of Colfax County had real cause to celebrate when Director of Operation and Maintenance Division, E. D. Eaton, turned the first shovel of earth, near the old Stubblefield Dam, symbolizing the beginning of construction. Within seconds after he presented the gold-plated shovel, used for the ceremony, to R. T. Lingle, engineer for the Vermejo Conservancy District, huge tractors and bulldozers began moving mountains of earth to Stubblefield Dam, one of three in line for repairs. Approximately 1,200 persons attended the celebration, which was arranged and conducted entirely by the Vermejo Conservancy District Board of Directors.

AT VERMEJO CELEBRATION, sponsored by the Directors of the Vermejo Conservancy District, E. D. Eaton, Director of Reclamation's Operation and Maintenance Division addresses the crowd on the site of old Stubblefield Dam. *Photo by F. S. Finch, Region 5.*

Among the distinguished guests present were United States Senator Clinton P. Anderson, who addressed the celebrants; Oscar Love, Middle Rio Grande Conservancy District Board; John P. Murray, Middle Rio Grande Flood Control Association; Robert Tripp, Albuquerque Chamber of Commerce; Berl Huffman, Albuquerque Chamber of Commerce; leading reclamationists Harry Tellyer, of Albuquerque, and Ed Foster of Farmington, N. Mex.; F. M. Rutherford, C. R. Miller, J. C. Matthews, Hugh F. Littrell, and Joe Pompeo of the Vermejo Conservancy District Board of Directors. #

"GET ACQUAINTED" COPIES

If you have friends or associates who would be interested in the RECLAMATION ERA, please send their names and addresses to the Bureau of Reclamation, Washington 25, D. C. We shall be glad to send them copies of back issues.



Like to be a FROG FARMER?

by B. BRUCE BARNUM, Agricultural Aide, Sacramento Valley District, Chico, California, Region 2

Frank Ondricek, owner of the Orland Variety Store, is celebrating the third anniversary of his favorite spare time project—frog farming.

Located 4¼ miles northeast of Orland on Summit Avenue, Mr. Ondricek's frog farm is a unique enterprise among the diversified operations on the Orland Reclamation project of northern California.

Stimulated by an almost insatiable market for frogs and an unlimited capacity for outdoor work, Mr. Ondricek began construction of his frog-breeding ponds in March 1951. Although nearly 4 years are required to raise frogs to top size, Mr. Ondricek expects to market around 500 frogs this season.

Mr. Ondricek's frog farm occupies an area 120 by 150 feet and is enclosed by a 5-foot wire mesh fence. Within the enclosure, an electrically charged wire at the top and a sheet metal strip, extending 15 inches into the ground at the base, keep the frogs in and the predators out.

Within the enclosure lie a series of shallow, parallel ponds, each approximately 14 by 105 feet, separated by wood fencing but connected by water pipes to permit an exchange of water. All the ponds have been made seepage-proof with tamped clay linings except one central seepage pool which collects overflow from the other ponds.

Pond depth averages 36 inches, except for a 4-foot deep silt-filled pit in the center which provides space for the frogs to hibernate during winter months. Water weeds are grown in the pools to oxygenate the water and to provide protective cover for the frogs. The mosquito hazard is easily controlled by introducing mosquito fish which feed on the mosquito larvae. The fish multiply rapidly and provide an important part of the frogs' diet.

"I got my original stock of frogs from streams near here," explained Mr. Ondricek, "although the breed, trade named Nufond Giant, originally came from the Southern States, notably Louisiana. Both bull frogs and green frogs grown here attain good size. The bull frog is larger, scaling from 3 to 3½ pounds at maturity. Males and females are about the same size but are distinguished by larger ear disks in the male. The male is the vocal member of the pair."

Characteristic of lower forms of animal life, the frog has an intermediate body form which it retains for a period ranging from 4 months to 3 years. In this intermediate stage the frog stays submerged in the water, breathes by means of gills and swims around by whipping its long, fleshy tail and behaves generally like a fish. Gradually its tail disappears and he is transformed into a true amphibian—at home in the water or on land.

Mr. Ondricek explained that two of his ponds are used for breeding ponds. Here, eggs are deposited by the females and fertilized by the males. Floating on or near the surface of the water, the eggs are collected and transferred to the tadpole ponds where they can safely hatch and develop through the tadpole stage into small frogs.

"Feeding my frogs is a more complicated process than you might think," said Mr. Ondricek. "Both tadpoles and frogs are heavy eaters. Naturally both are capable of securing a certain amount of food for themselves. Those lights above the ponds go on automatically at night to draw flies and other insects to the pond areas. My frogs feed heavily upon them. However, to speed up their growth in size and weight and

improve the quality of their meat, supplementary feeding is important."

Tadpole feeding is relatively simple, for they will eat "still" food. Ground liver and spleen, chicken mash, even bread and cottage cheese placed in the pool are acceptable.

Frog feeding is a different story. They must have "live" food—practically anything of reasonable size that moves will be snapped up. To feed his many frogs, Mr. Ondricek has devised a simple but very effective system of mass feeding-bait lines. Small link chains, two to a pond, are strung the length of the ponds and several feet above the water. The ends of the chains extend outside the pond enclosures and are fixed to a cable running around two sides of the frog yard. A slow-geared electric motor, located at one end of the cable, imparts a reciprocating motion to the cable and, in turn, to the chains over the ponds. Tension as well as freedom of movement for the cable is accomplished by coiled spring mountings at the end and corner posts. The frogs flick the feed from the wires with their long tongues.

Bits of liver and spleen are loosely fastened to the ends of fine copper wires hung at 6-inch intervals along the bait lines and allowed to dangle just above the pond surface.

"We feed the frogs daily during summer months," Mr. Ondricek explained. "The wires are baited by hand and takes less time than you might think. When we finish, all we do is take off our wading boots, go to the motor and throw the switch. Those fellows never miss a meal!"

Although only the legs are commonly served for food, the whole dressed carcass is sold to the dealers. Premium size frogs run over 3 pounds but 2-pound frogs are considered to be of butchering size. ###

FROG FARMER ONDRICEK displays one of his ready-to-market product in above photo. Frog weighs between 2½ to 3 pounds and is 12 inches long. Specimens are frequently larger than this one. Below—view of the breeding pond. *Photos by the author.*

Fertilizer + Irrigation = Time Saving

(The following article is based on information contained in the publication, Distributing Fertilizer Through Irrigation Systems, prepared by the Portland (Oreg.) General Electric Co.)

A good way to do two jobs at once and save time and effort in the bargain is to apply fertilizer at the same time you irrigate.

If you irrigate with a sprinkler system, it's easily done by dissolving soluble fertilizers in water and applying the solution through your system. Requiring only a minimum of equipment and only a fraction of the effort involved in applying fertilizer mechanically, sprinkler irrigation-fertilizing is attracting more farmers all the time.

You can regulate the penetration of the fertilizer into the soil by controlling the time of fertilizer application in relation to the total irrigation period. Generally, it is best to apply the fertilizer within two hours of the end of the run, in 15 or 20 minutes time. Water passing through the system after the fertilizer is shut off cleans the lines and sprinklers, and carries the fertilizer into the top few inches of soil. Applying the fertilizer earlier during the sprinkling, will cause it to pentrate the soil more deeply. Experience will soon show the best method for your particular crop and conditions.

The fertilizer can be dissolved in water in a container such as a barrel, in the approximate ratio of 1 pound of fertilizer per gallon of water. The barrel or other container should be located adjacent to the irrigation pump for convenience in adding the fertilizer solution to the irrigation water. The method of doing this will vary with the type of pump being used for irrigation.

Addition of fertilizers in solution to centrifugal pump irrigation systems is relatively simple. All that is needed is a pipe extending from near the bottom of the fertilizer container to the suction pipe of the pump, with a shut-off valve at a convenient point between.

Another pipe from the discharge side of the pump to the fertilizer container provides an easy method of filling it with water for dissolving the fertilizer, and rinsing it afterward. A hose is sometimes used instead of a pipe where flexibility is desired.

A diagram illustrating a typical set-up is shown in FIGURE 1.

On an irrigation system using a turbine pump, the liquid fertilizer must be introduced into the irrigation water under pressure exceeding that of the discharge at the pump. One method of accomplishing this is to use a small motor-driven gear or paddle pump.

The hook-up is shown in FIGURE 2.

To avoid corrosion after the fertilizer solution is pumped into the line, it is well to refill the barrel with water and run it through the pump, repeat-

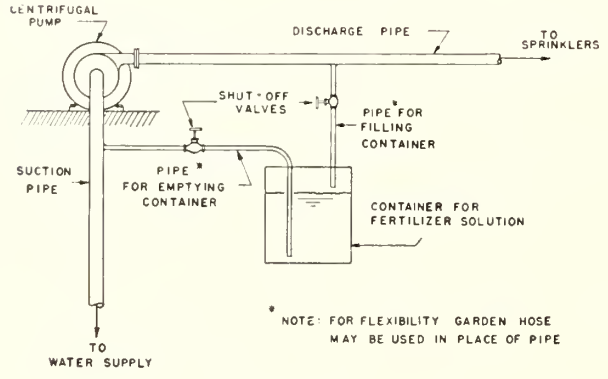


FIGURE 1

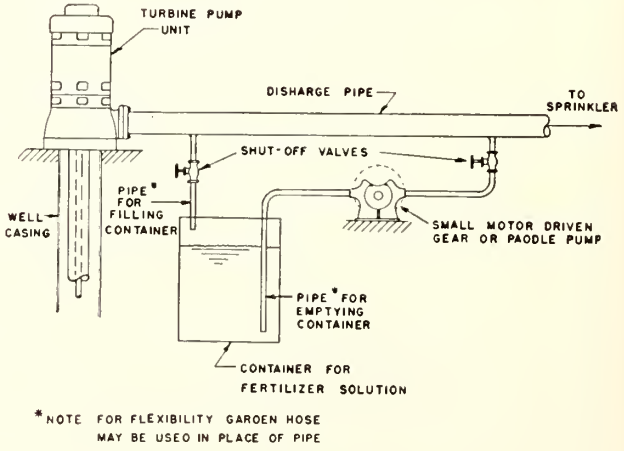


FIGURE 2

ing the operation several times to rinse the pump and barrel thoroughly.

Fertilizers in solution may be introduced into irrigation water with the aid of an aspirator or jet unit. A portion of the water discharged from the pump is bypassed through the aspirator, creating suction that will draw the fertilizer solution into the line. The hook-up is illustrated in FIGURE 3.

It is essential to have valves for regulating the relative flow through the aspirator and the main line. The cost of the valves, plus the necessary pipe fittings and aspirator unit may make this system as expensive as a small gear or paddle pump unit, or even more so. However, it has the advantages of simplicity and freedom from moving parts. It should be noted that operating the valves in connection with the venturi reduces the pressure at the last sprinkler if the system is underdesigned or underpowered. The result is the application of the fertilizer in an uneven pattern.

The amount of fertilizer to apply during each lateral setting can be determined easily from the table below. In the right-hand column of the table, the amount of fertilizer to apply for an application rate of 100 pounds per acre, with 60-foot lateral settings, is indicated. Lesser or greater rates of application can be calculated from these figures, as shown in the example following the table.

QUANTITY OF FERTILIZER REQUIRED PER LATERAL SETTING

Lateral length in feet	*Number of sprinklers (at 40 foot spacing)*	*Area covered per 60 foot setting, in acres*	*Quantity to apply per setting, for rate of 100 pounds per acre*
			Pounds
160	4	0.22	22
200	5	.28	28
240	6	.33	33
280	7	.39	39
320	8	.44	44
360	9	.50	50
400	10	.55	55
440	11	.61	61
480	12	.66	66
520	13	.72	72
560	14	.78	78
600	15	.83	83
640	16	.89	89
680	17	.95	95
720	18	1.00	100
760	19	1.05	105
800	20	1.10	110
840	21	1.16	116
880	22	1.21	121
920	23	1.27	127
960	24	1.32	132
1,000	25	1.38	138

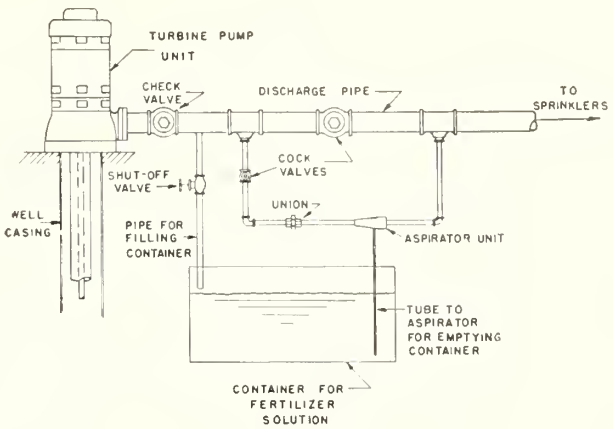


FIGURE 3

For example, an operator wishes to apply fertilizer at the rate of 300 pounds per acre. He is operating 400 feet of lateral, and moves it 60 feet along the main line at each setting. How many pounds of fertilizer should he apply at each setting of the lateral?

Referring to the quantity column at the right side of the table, opposite a lateral length of 400 feet we find that 55 pounds of fertilizer must be applied per setting, to apply it at the rate of 100 pounds per acre. Multiplying 55 by 3, we obtain 165 pounds as the quantity of fertilizer to apply at each setting of the lateral, for an application rate of 300 pounds per acre.

To obtain the quantity required for lateral moves other than 60 feet, multiply the quantity figure in the previous table by a correction factor, as follows:

Lateral moves along main, in feet	Correction factor	Lateral moves along main, in feet	Correction factor
30	0.500	80	1.330
40	.667	100	1.667
50	.835		

For example, assume that an operator is making 50-foot moves of the lateral along the main line. He has 960 feet of lateral and wishes to apply fertilizer at a rate of 400 pounds per acre.

From the table we find that with 60-foot moves, 960 feet of lateral requires 132 pounds of fertilizer per setting. Multiplying 132 by 0.835 (the correction factor for 50-foot moves) gives 110 pounds per setting. Multiplying 110 by 4 gives 440 pounds as the quantity of fertilizer to be applied at each setting of the lateral, to apply it at the rate of 400 pounds per acre. ###

RECLAMATION'S "IRRIGATION LABORATORIES"

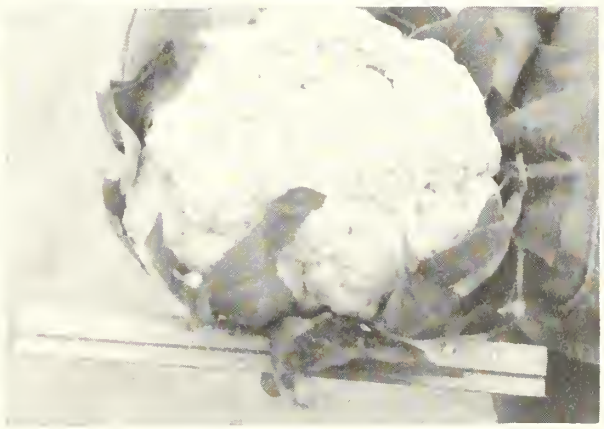
SOY BEANS, above left, yield 53 bushels per acre under irrigation. Immediate left, beef cattle on the irrigated alfalfa-brome pasture of the Huron Farm. Gains of 476 pounds of beef per acre were realized during season. ***Photo by C. A. Knell, Region 6.***

With the future possibility of having controlled water on 750,000 to 1,000,000 acres of land in the James River Valley of South Dakota, the Bureau of Reclamation, South Dakota State College Agricultural Experiment Station and the Bureau of Plant Industry, Soils and Agricultural Engineering, are gathering information on irrigation agriculture in this area prior to bringing irrigation water into the James River Valley from the Missouri River.

The laboratories for this work are two development farms established by Bureau of Reclamation. One is located 6 miles east of Redfield and the other 4 miles southeast of Huron, both of which are in the James River Valley of South Dakota. Each of these farms has approximately 130 acres of irrigated land. The irrigation water is pumped to the high point on each farm from the James River by electrically powered pumps. The Redfield Development Farm is located in the Dakota Lake Plain on Beotia or Bearden silt loam. The Huron Development Farm is on a Barnes loam soil. Both of these soils series are common to a large portion of the James River Valley.

The development of the Oahe Unit in South Dakota by the Bureau of Reclamation was ap-

PRIZE SIZE cabbages grown on Redfield Development Farm, immediate right. The yield per acre is 23 tons. Photo below shows size of cauliflower grown on the same farm, worth a yield of 9 tons per acre.



proved by the Congress in the Flood Control Act of 1944. As a part of this program, these farms, under actual field conditions, will provide basic data required for the future irrigation development of this proposed Oahe Unit. These data will include information on cropping practices, crop varieties adapted to irrigation in the area, yields that may be anticipated under irrigation, practical methods of water application, water requirements for irrigated crop production, and the effects of irrigation on the soils represented by the farms.

A third development farm, or working laboratory in the Bureau's Missouri-Oahe District, is in its second year of production and is located on the Shadehill Unit of the Grand River near Lemmon, S. Dak. This farm contains 35 acres and the water is supplied by an electrically powered pump from the reservoir back of the Shadehill Dam. The Shadehill Development Farm was planned and developed for the purpose of testing the reaction of respective soils of the proposed project lands to sustained application of high-sodium water, and to determine, if possible, a suitable method of counteraction by the use of soil amendments and leaching, whereby adequate internal drainage may be maintained for long-time irrigated crop production.

Each year thousands of farmers, businessmen, and other interested persons, visit these farms in regular, organized tours. Individuals and groups visit the farms nearly every day throughout the crop-growing season. One of the statements most frequently heard by these observers is "this coming irrigation in the James River Valley should go a long way in stabilizing the agriculture of South Dakota."

It is believed that the visitors realize the many changes that will take place in the transition from dry land to irrigated farming. Many feel that the cropping pattern will gradually change from wheat and other small grains to a much larger production of alfalfa, pasture, soybeans, corn, potatoes, and sugar beets, and possibly to considerable truck gardening as well as increase livestock production. They also know that this will mean much additional agricultural industry, such as canneries, beet sugar factories, alfalfa dehydrating plants, additional creameries, packing plants, etc. Also, this will mean a change in the size of the farm from its present average of 500 acres per operator to much smaller units under irrigation, all of which will provide better support and greater stability to a larger population in the rural and urban areas.

The average precipitation at the Redfield farm during 1948–52, inclusive, was 13.46 inches during the growing season (April 1 to October 31). In

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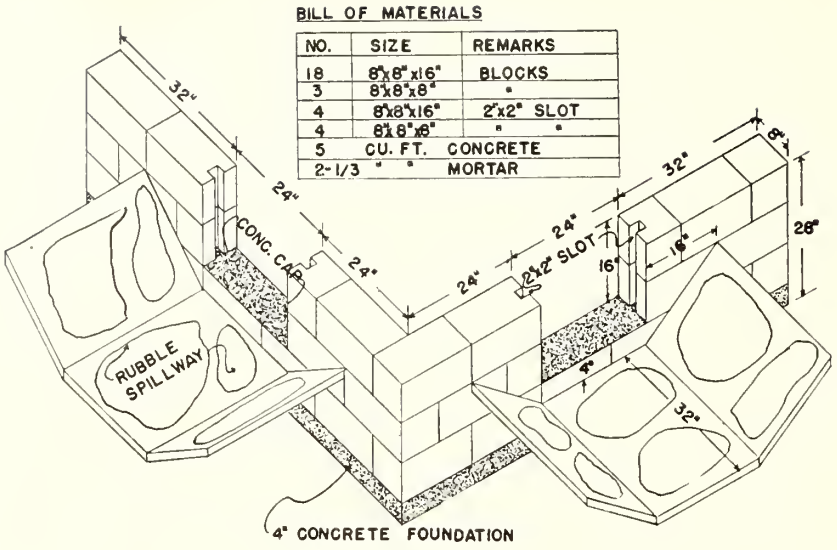


At left 2-Way Diversion-Concrete Block. On the next page is another type of 2-Way Diversion-Concrete Block as well as a 3-Way Diversion-Concrete Block. *All illustrations in this article are courtesy of the Agricultural Extension Service, University of Wyoming, Laramie, Wyo.*

LOW COST IRRIGATION STRUCTURES

(First of a series of three articles based on information contained in Circular 122, a publication of the University of Wyoming, Extension Service, Laramie, Wyo.)

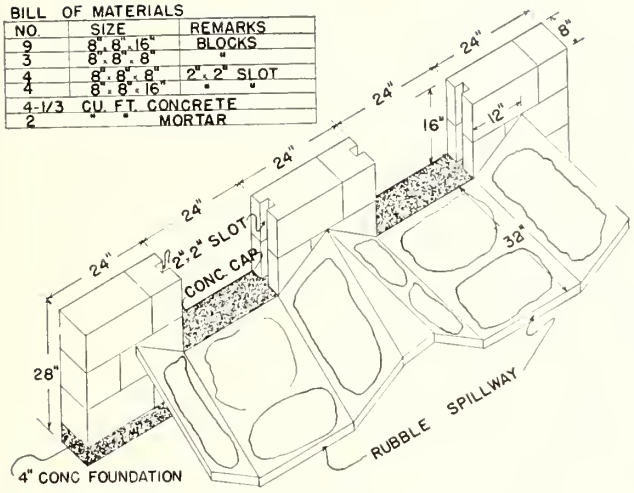
One of the wisest investments an irrigator can make is in durable, efficient control structures. Properly placed and correctly used, they can reduce time-consuming labor, save soil, conserve precious water, and permit the farmer to leave the water unattended and not have to worry about washouts.

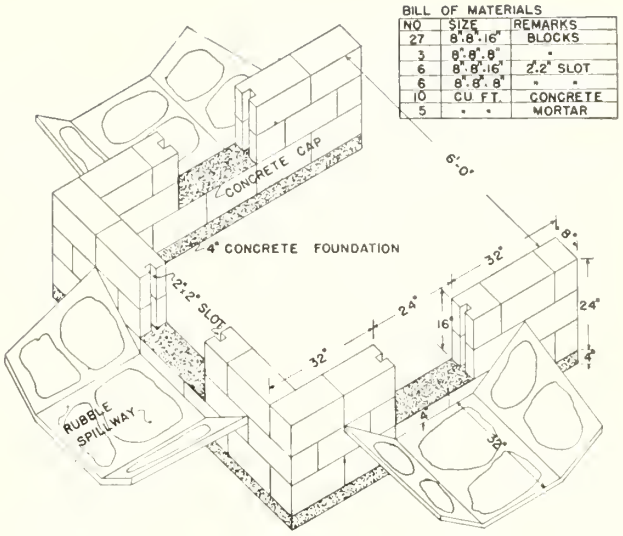
"But such control works are expensive—they take time to build," you say? Actually they're a lot less expensive than you might think. Irrigation structures that once cost up to $150 for a single concrete installation can now be built by the average farmer for from $40 down to less than $20, thanks to recent experimentation by irrigation farmers and researchers.

Typical of the durable, efficient structures recently developed and proven through operation is the 2- or 3-way concrete block diversion structure. The diversion of water from a single ditch into 2 or more ditches is a "must" for good water control. Often this vital diversion is performed by the farmer skillfully manipulating his shovel. Although such shovel work forms an important part of the tradition of irrigation farming, a concrete block structure can do the job better while saving time, labor, and preventing waste of water.

A 4-inch concrete foundation is the first step in constructing the diversion. Care must be taken to be certain that the foundation is fairly level on top. The first row of 8- by 16-inch concrete blocks is placed on the fresh concrete, making sure that a good bond is formed. Another row of blocks is then mortared in, and a concrete cap is placed on top of the blocks forming the bottom of the diversion opening. Facing the diversion opening are blocks with a 2-inch square groove to accommodate the check board. Of course, height and arrangement of diversion openings can be easily adjusted to meet specific needs. Depending on the locality, the grooved blocks may have to be specially ordered. Rubble or concrete spillways should be provided on the down-face of the diversion to eliminate the danger of soil erosion around the diversion.

The blocks used should be of dense concrete, not the lightweight type. For best results, it is recommended that all concrete mixes be 1 to 2¾ to 4 (volumes of cement-sand-gravel), with a water-cement ratio of 5½ gallons per sack of cement.





Mortar mixes should be 1 to 2½ (volume of cement to volume of sand), or 1 to 1 to 5 for cement, hydrated lime, and sand mix.

If the materials are handy, the structure can be put up in a half day. The cost of materials will vary, depending on locality, but will probably be around $20 for the 3-diversion structure illustrated here. The 2-way diversion should be correspondingly less.

When lumber is used in construction of the structures, it is recommended that it be preservative-treated.

Design and arrangement of the diversions, of course, can be varied so that they will divert water into ditches meeting at an angle, create combination diversions and drops, or meet any other special needs of the farm's distribution system. ###

Ground-Water Data In Columbia Basin Project, Washington, Released

Irrigation of a portion of the 1 million-acre Columbia Basin Project with water pumped from the Columbia River, started in 1952, and its possible effects on the water table make information on ground-water conditions in the area increasingly important, Secretary of the Interior Douglas McKay recently stated.

Ground water is almost the sole source of supply in the area for domestic, municipal, and industrial use, and large amounts have been used for irrigation according to a recent Geological Survey report on ground-water conditions and resources in the area.

The report entitled "Progress report on ground water in the Columbia Basin Project, Wash.," was prepared by M. J. Mundorff, D. J. Reis, and J. R. Strand. It can be examined at Geological Survey offices, 2128 South 38th Street and 207 Federal Building, Tacoma, Wash.; and 2209 General Services Building, Washington 25, D. C.; at the Division of Water Resources, Transportation Building, Olympia, Wash.; the Bureau of Reclamation, Ephrata, Wash.; and the public libraries of Seattle, Spokane, and Ephrata. •

Contract Awarded for Sly Park, California, Dam

A Bureau of Reclamation contract for construction of Sly Park Dam near Camino, El Dorado County, Calif., as part of the Sly Park Unit of the Central Valley Reclamation project, has been awarded to Frederickson & Watson Co. and M & K Corp., Oakland, Calif.

The 190-foot high, 760-foot-long earth-fill dam and 600-foot long dike will create a 41,000 acre-foot capacity storage reservoir for presently uncontrolled flows of Sly Park and Camp Creek waters needed for irrigation, domestic, and industrial purposes in Placerville, Camino, and surrounding areas. •

Reclamation's Laboratories

CONTINUED FROM PAGE 123

comparing irrigated to dry-land yields in this area (dry-land yields taken from South Dakota Crop and Livestock Reporting Service), corn yielded, 375 percent; alfalfa, 333 percent; and potatoes, 503 percent through irrigation over yields from dry-land farming.

Redfield Development Farm Crop History from 1950 through 1952

	Alfalfa (tons)		Corn (bushels)		Oats (bushels)		Barley (bushels)		Potatoes (bushels)		Beets (tons irrigated)
	Irrigated	Dry	Irrigated	Dry	Irrigated	Dry	Irrigated	Dry	Irrigated	Dry	
1950	4.0	1.4	60.0	22.0	53.5	19.0	53.6	14.0	500	95	22
1951	4.6	1.6	95.4	18.0	71.3	39.0	51.2	26.0	536	110	30
1952	6.3	1.6	88.6	25.0	----	16.0	26.7	8.0	510	----	25
Average	5.0	1.5	81.5	21.7	62.4	24.7	43.8	16.0	515.3	102.5	25.7

Redfield Development Farm Irrigated Truck Crops 1951

[Year of greatest diversification]

Truck crop	Tons per acre	Truck crop	Tons per acre	Truck crop	Tons per acre
Cabbage	23.06	Lettuce	21.78	Peppers	9.07
Cauliflower	9.06	Cucumbers	16.63	Sweet corn	3.0
Broccoli	3.86	Squash	16.29	Tomatoes	16.24

The Huron Development Farm has been operating primarily as a livestock unit and for the production of variety feeds, including corn, small grains, grasses, and legumes. Irrigated pastures are used by livestock on an experimental basis by South Dakota State Agricultural College.

Huron Development Farm Pasture Trials, Irrigated and Native

[120-day period]

	Irrigated alfalfa-brome pounds of beef gain/acre	Dry land native pounds of beef gain/acre		Irrigated alfalfa-brome pounds of beef gain/acre	Dry land native pounds of beef gain/acre
1948	----	99	1951	375	134
1949	400	90	1952	476	71
1950	354	92	Average	401.2	97.3

Information regarding proven practices and crops under research will be used in the future as part of the recommendations to farmer-irrigators in the area as based on findings of agricultural research in these field laboratories under the cooperative supervision of South Dakota State College Experiment Station, the Department of Agriculture, and the Bureau of Reclamation. ###

Protect Your Fence Posts

Should you treat your fence posts? The answer will probably be "Yes" for most farmers, for thousands of dollars are spent each year to replace rotted fence posts. The proper preservative applied to these posts could have saved countless dollars and added years to the usefulness of the posts.

Careful research should be done in selection of the post and preservative. For example, untreated locust, oak, and cedar resist decay and termites longer than softer woods. Proper selection of the best available native wood and correct treatment should give longer lasting posts plus adequate protection of crops and livestock for many years.

Cutting time, seasoning, treatment and even peeling have advantages to be considered.

For instance, the bark peels best in the spring and early summer, but seasoning in the summer is likely to be so rapid that it may result in severe checking. Wood cut during hot weather and carelessly piled may become infected by insects and wood rotting fungi. Wood cut during winter is not subject to insects, and if peeled, usually is dry enough by warm weather to avoid decay or rot.

Seasoning would be correctly done if the logs are piled so the air can circulate freely through them. If the posts are raised at least a foot above the ground and not close-piled or allowed to lie or stand on the ground before treatment decay will not start before they are seasoned. No method of piling is satisfactory that permits any part of the post to rest on the ground.

For further information on this subject, the Department of Agriculture has issued a new Farmers Bulletin, No. 2049, entitled "Preservative Treatment of Fence Posts and Farm Timbers," which may be obtained free by writing to the Department of Agriculture, Washington, D. C. #

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Let us know immediately so we can change our mailing list—it takes time, you know.

We'll do our best to deliver the RECLAMATION ERA to your correct address, but we have to know what it is.

Light, Frequent Irrigation Best

CONTINUED FROM PAGE 116

1. The total yield and yield of No. 1's will be decreased.
2. The yield of bottleneck and pointed-end tubers will be increased.
3. The yield of undersized tubers will be increased.
4. The top weight of the vines will be decreased.
5. There will be a loss of russetting on the tubers.
6. The soil temperature will be higher.

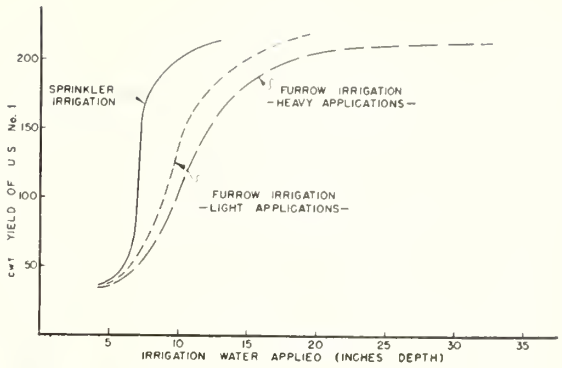
Below are some other general indications from the experiments:

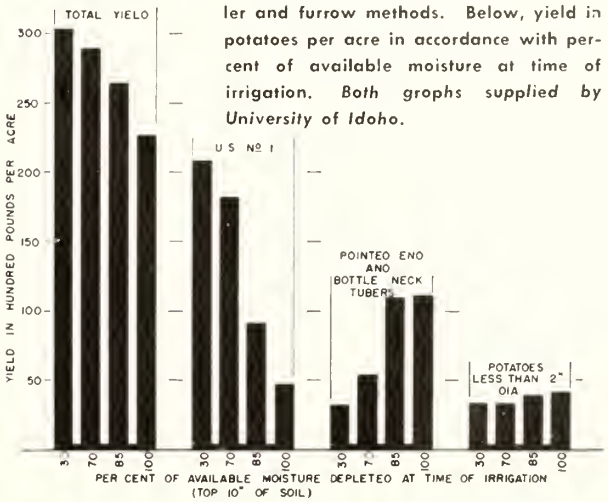
1. The yield of knobby tubers is not affected by irrigation.
2. Specific gravity (density or weight per unit volume) of the tubers is not affected by irrigation.
3. Growth cracks are increased by heavy irrigation.
4. The number of tubers per plant and the depth of tuber set is not affected by irrigation.
5. The higher the soil temperature, the higher the yield of pointed-end and bottleneck tubers.

It was also found that irrigation has little effect on the severity of the early dying disease, prevalent in the area. This is a disease that kills the vines early in the season, before the tubers reach maturity. Little is known about the disease, including the cause of it. Some believe it is a soil-borne virus. Delaying the first irrigation will delay the onset of the disease; however, once the disease does start after a delayed first irrigation, its progress is very rapid and the plants are soon completely dead.

Sprinklers showed a tremendous saving in water over furrow irrigation in the Aberdeen experiment. To maintain equal soil moisture content in the upper 10 inches of soil about one-half as much water was needed with the sprinkler system.

The importance of soil temperature in the production of good quality potatoes was shown. There was a definite increase in the amount of pointed-end and bottleneck tubers with the warmer soil temperatures during July. Sprinkler plots were not significantly cooler than furrow-irrigated plots, but plots which were irrigated most frequently remained cooler throughout the growing season. ###





Above, comparison of irrigation by sprinkler and furrow methods. Below, yield in potatoes per acre in accordance with percent of available moisture at time of irrigation. *Both graphs supplied by University of Idaho.*

Savage Rapids Dam Rehabilitation Under Way

Emergency repair work has been started on Savage Rapids Dam on the Rogue River near Grants Pass, southwestern Oregon. The Bureau of Reclamation awarded the contract to the Young and Smith Construction Company, Salt Lake City, Utah.

Under the contract award, the spillway gate system at the dam will be rebuilt, the spillway apron repaired, and other improvements made in the vicinity of the dam to assure the safety and efficient operation of the water diversion structure. •

New Map of Irrigated Lands

The Bureau of the Census has just completed a new map showing irrigated lands in the 17 Western States, Arkansas, and Florida. It is 34 x 41½ inches and may be purchased from the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C., for 35 cents.

LETTERS

Gopher Articles Helpful

MARCH 6, 1953.

DEAR SIR:

Some time ago you published a very interesting article in the RECLAMATION ERA pertaining to the eradication of gophers.

Apparently we have lost or loaned this issue, which we considered very valuable. We would be very grateful to you if you could obtain this issue, or a copy of this article and forward it to us.

We have had a number of inquiries regarding this article and we are of the opinion that this will be most beneficial.

Yours very truly,

E. O. DAGGETT, *Manager*,
Farmers Irrigation District,
Scottsbluff, Neb.

We were pleased to send Mr. Daggett copies of the articles "Gassing the Gophers" and "Gas Chamber for Gophers" which appeared in the September 1951 and February 1952 issues of the RECLAMATION ERA.—Acting Ed.

They Read It Around the Globe

MSA. APO 206–A
% Postmaster
NEW YORK, N. Y.
March 1, 1953.

DEAR SIR:

From the address given above you could not tell that I am now living in Ankara, Turkey, and working through this country as a member of the Agricultural Advisory Commission to the Turkish Ministry of Agriculture. We use the above address because mail will then go for the United States domestic rate.

Today begins our eleventh month in Turkey, or in other words we arrived here just 10 months ago today. We were in Washington for 10 days before coming over but they kept me too busy to get around.

Guess I better call attention to the enclosed slip, and my check for $2.00 to keep the ERA coming for the next 2 years. We expect to return to the United States when our 2 years are up. I want to tell you how much I appreciate receiving the ERA. Just last week I was laid up for a couple of days with the flu, and caught up with reading them. They are good.

Sincerely yours,

RALPH E. JOHNSTON.

RELEASES

Hoover Dam Folder

An illustrated folder (revised) was recently released by the Bureau of Reclamation entitled "Hoover Dam." A limited supply is available free of charge from the Bureau of Reclamation, Supply Field Division, Attention 841, Building 53, Denver Federal Center, Denver 2, Colo. ●

Magic Water

The latest illustrated folder on the Columbia Basin which was released recently is entitled "Magic Water for the Columbia Basin Project." Copies may be had free of charge by requesting them from the Bureau of Reclamation, Supply Field Division, Attention 841, Building 53, Denver Federal Center, Denver 2, Colo. ●

DO YOU KNOW . . . .

● To ship all the citrus and vegetables that are produced each year in the Lower Rio Grande Valley, Texas, by rail in a single train, it would require a line of railroad cars 600 miles in length or roughly the distance from New York to Toledo, Ohio?

NOTES FOR CONTRACTORS

Contracts Awarded During April 1953

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DS–3870	Missouri River Basin, S. Dak.	Apr. 9	One 69,000-volt voltage-regulating transformer, rated 50,000/66,667-kilovolt-ampere output capacity, for Sioux City substation.	American Elin Corp., New York, N. Y.	$61, 110
DC–3887	Missouri River Basin, S. Dak.	Apr. 14	Second stage construction of Armour, Tyndall, and Woonsocket substations.	Lipsett, Inc., New York, N. Y.	35, 918
DC–3888	Central Valley, Calif.	Apr. 17	Construction of Sly Park dam	Fredrickson & Watson Construction Co. and M & K Corp., Oakland, Calif.	2, 716, 785
DC–3896	Columbia Basin, Wash.	Apr. 6	Installation of rubber joint strips in Grand Coulee right power plant.	Elbert L. Powell and R. L. Beasley, Coulee Dam, Wash.	20, 864
DC–3897	Colorado-Big Thompson, Colo.	Apr 7	Construction of earthwork, structures, and surfacing of Pole Hill access road, Flatiron section, Estes Park-Foothills power aqueduct.	Western Foundation Construction Co. and C. F. Stirn, Denver, Colo.	110, 750
DC–3903	Columbia Basin, Wash.	Apr. 24	Painting for Grand Coulee pumping plant, power plant, elevator towers, siphon breaker house, right switchyard service building, and right switchyard.	F. O. Repine Co., Salem, Oreg.	25, 894
DC–3905	do.	do.	Earth blanketing Potholes East canal	L. D. Shilling Co., Inc., Moses Lake, Wash.	233, 400
DS–3939	Davis Dam, Ariz.-Calif.-Nev.	Apr. 3	Repair of field pole assemblies of synchronous condenser at Phoenix substation.	General Electric Co., Denver, Colo.	11, 860
117C–184	Columbia Basin, Wash.	Apr. 14	10-truck garage and equipment storage building at Royal O&M Headquarters.	United Industries, Inc., Richland, Wash.	12, 783
117C–186	do.	Apr. 21	Supplemental waterway, drain, and structures, areas P–1 and P–2.	McWaters & Bartlett, Boise, Idaho.	35, 064
617C–34	Riverton, Wyo.	Apr. 14	Open and closed drains in North Pavillion and North Portal areas.	Basel & Whitehead, Riverton, Wyo.	59, 491
704C–275	Colorado-Big Thompson	Apr. 7	Construction of 13.8-kilovolt distribution and control lines in Foothills area.	Snowden Electric Co., Denver, Colo.	31, 027

Construction and Materials for Which Bids Will Be Requested by August 1953

Project	Description of work or material
Cachuma, Calif.	Placing a 1-inch plant-mix surfacing course over the full width of a portion of State Highway 150 to a total width of 20 feet. The work will include furnishing and placing 16 tons of asphaltic emulsion (paint binder) and 4,770 tons of plant-mix surfacing.
Do.	Construction of Goleta distribution system laterals 10 to 16 and pumping plant in lateral area 13-1, along U. S. Highway 101 between Goleta and Santa Barbara, Calif., requires furnishing and laying about 12 miles of 2- to 14-inch diameter steel pipeline and constructing a plant to house one 100 gallons per minute and three 200 gallons per minute pumps at 225-foot head, and install one pump of each size. The plant will have a steel air chamber with compressor for equalizing line pressures. About 11.5 miles of pipe 3 inches and over is to be mortar-lined. Laterals include pipe, fire hydrants, pressure reducing, air-and-vacuum relief and pressure-relief valves, all contractor-furnished, weighing about 430 tons.
Central Valley, Calif.	Construction of 58 miles of 12- to 66-inch diameter reinforced concrete pipeline, monolithic concrete moss screens, and low-head pumping plants, valves, slide gates, miscellaneous metalwork, and electrical controls for Unit 1 of Delano-Earlimart Irrigation District distribution system, Friant-Kern Canal, located in Tulare county near Earlimart, Calif.
Do.	Construction of 11 miles of 12- to 30-inch diameter concrete pipelines, including 12 gravity turnouts and 12 turnouts with pumping plants of 9 to 2 cubic feet per second capacities, for Plainview Water Irrigation District distribution system on the Delta-Mendota Canal, about 5 miles southwest of Tracy, Calif.
Do.	Modifying gravity turnouts along Delta-Mendota Canal.
Columbia Basin, Wash.	Construction of area P-4 laterals (Block 13), sublaterals, and wasteways, varying from 288 to 3 cubic feet per second capacities. Work consists of excavating 45.3 miles of unlined laterals and wasteways with base widths of 2 to 16 feet, 14.5 miles of pipeline from 12- to 60-inch culvert and pressure pipe, concrete structures, including division boxes, checks, weirs, culverts, drops, 7 small pumping plants, and 3 bridges.
Do.	Placing floor finishes in a 4,200-square-yard area of Grand Coulee pumping plant at Coulee Dam, Wash., and installing 6,000 feet of base and 1,000 feet of curb.
Gila, Ariz.	Construction of 26 miles of unreinforced concrete-lined laterals, 9 miles of wasteway channels, 3 jacked-pipe railroad siphons, and checks, drops, pipe road siphons, turnouts, bridges, deliveries, and wash siphons for Unit 2 of Wellton distribution system to irrigate about 7,700 acres surrounding Wellton, Ariz. Work includes furnishing and laying about 1 mile of 30- to 54-inch diameter concrete pipe, about 360,000 cubic yards of lateral and structure excavation, and 400,000 cubic yards of channel and dike excavation.
Gila, Ariz.—Con.	
Minidoka, Idaho.	Drilling observation wells for North Side Pumping Division north of Rupert, Idaho.
Missouri River Basin, Kans.	Construction of 7 miles of unlined laterals and drains of 18 to 6 cubic feet per second capacities and unreinforced concrete structures for Courtland canal's second section near Mankato, Kans. About 69,000 cubic yards of excavation are involved.
Missouri River Basin, Nebr.	Installation of 4-inch pump with intake and discharge lines for removal of sand deposits at entrance to intake channel of Franklin South Side pumping plant near Franklin, Nebr.
do.	Construction of 2 24-inch diameter drain wells and 1 12-inch diameter abutment drain at Enders dam on the Frenchman Creek near Enders, Nebr.
Missouri River Basin, N. Dak.	This contract combines Buchanan and Edmunds road work. Buchanan work includes raising 0.5 mile of road and surfacing with gravel and constructing a bridge over the James River in the Jamestown reservoir area 10 miles north of Jamestown, N. Dak. About 130,000 cubic yards of excavation will be required. Raising about 1 mile of Edmunds road, surfacing with gravel and raising present steel truss bridge over the James River in Jamestown reservoir area about 23 miles north of Jamestown will require 15 tons of reinforcing steel, 45,000 cubic yards of excavation for road fill, 2,700 feet of wood piles, and 15 M b. m. structural bridge timber.
Riverton, Wyo.	Construction of open and closed drains in North Portal and North Pavillion areas near Riverton, Wyo.
Vermejo, N. Mex.	Rehabilitation of Vermejo diversion dam, 11 miles of 600 cubic feet per second Vermejo canal and 24 miles of 300 cubic feet per second Eagle Tail canal, 8 miles northwest of Maxwell, N. Mex. is to include: Revising the diversion dam headworks structure by lowering the gate sills, blocking the 9 existing openings, enlarging the outlet structure to 450 cubic feet per second capacity, and installing 9 new slide gates. The existing sluice gates will be replaced by 3 new slide gates with some earth dike and bank riprap protection. Canal and channel excavation, new sluiceway, siphous, wasteway drops and drainage inlet structures for Vermejo canal. Canal excavation, 1,400 feet of Kellner-type jetties-1,800 cubic yards of dumped riprap on river bank, gate, controlled sluiceways, checks, siphons, and drop structures for Eagle Tail Canal.

United States Department of the Interior, Douglas McKay, Secretary

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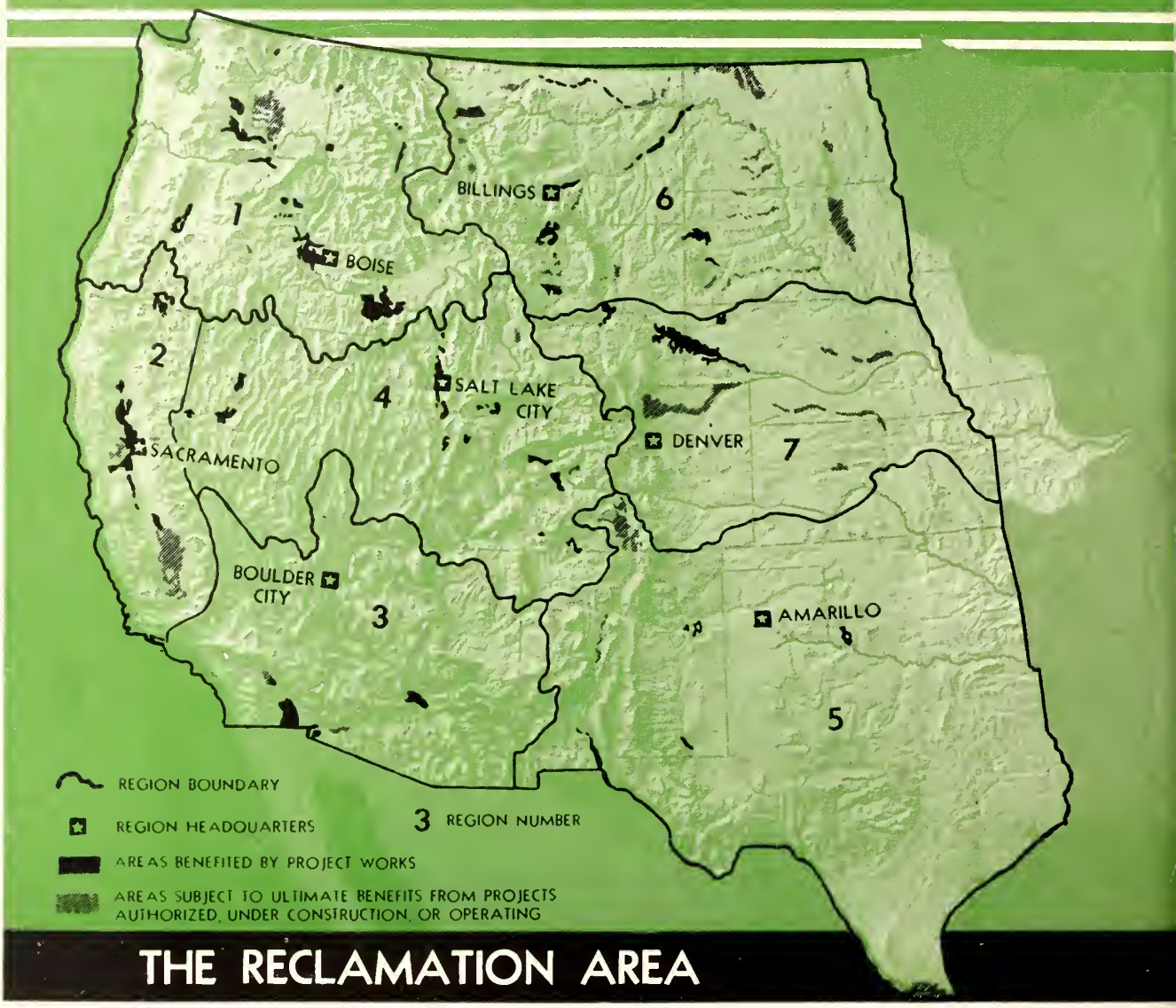

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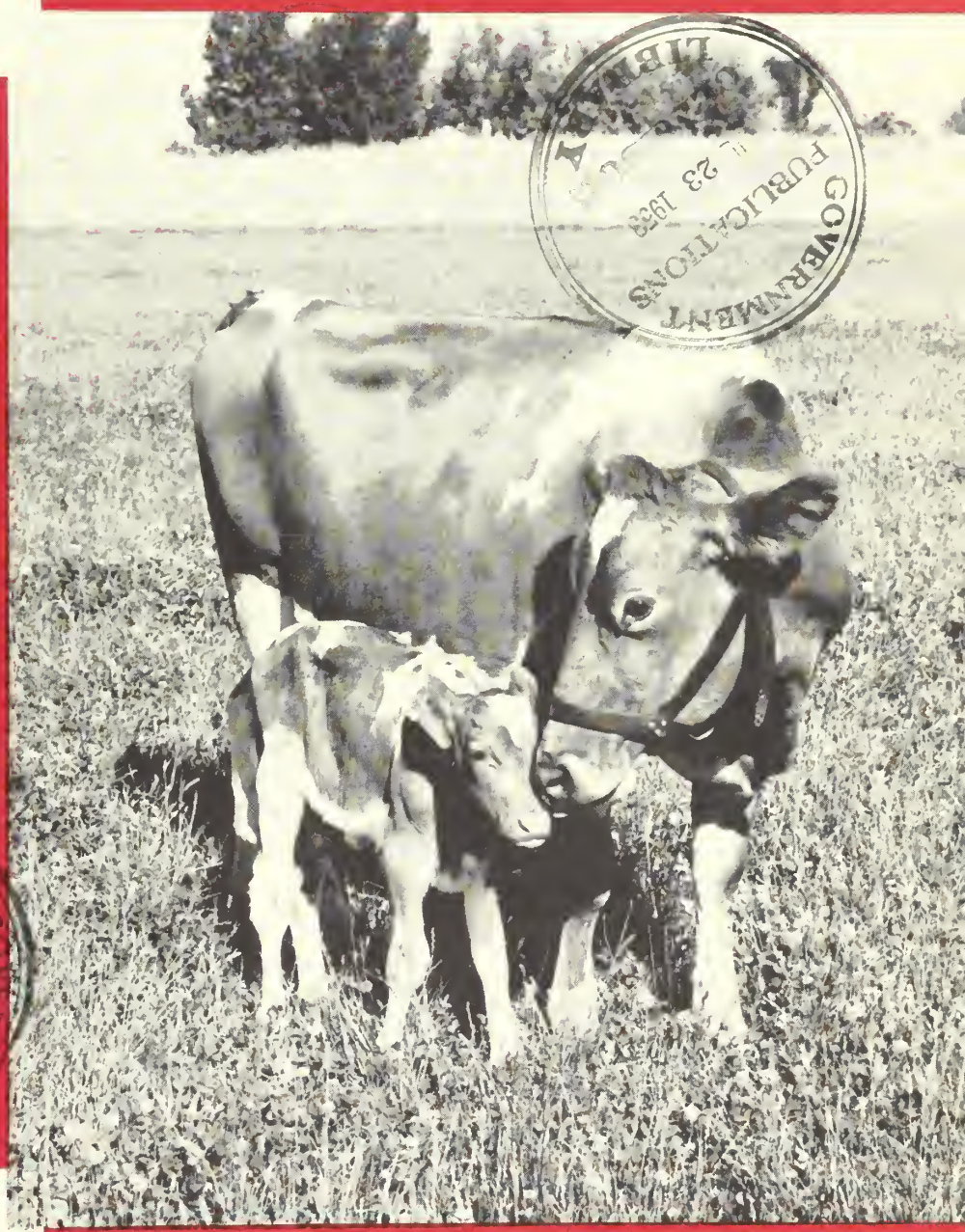
The RECLAMATION Era



IN THIS ISSUE

JULY 1953

OFFICIAL PUBLICATION OF THE BUREAU OF RECLAMATION

July 1953
Volume 39, No. 7

The Reclamation ERA

Special Notice To All Subscribers

Beginning this month the Reclamation Era will become a quarterly publication. Subscription rates will be 50 cents per year, 15 cents additional required for foreign mailing. Separate copies may be purchased for 15 cents each. Under the new policy all future subscriptions should be sent direct to the Superintendent of Documents, Government Printing Office, Washington 25, D.C. Subscriptions now in force will be extended for a maximum period of 2 years. If, at the expiration of that time, subscribers have not received all the copies due them under the previous subscription rate a refund will be made by the Superintendent of Documents.

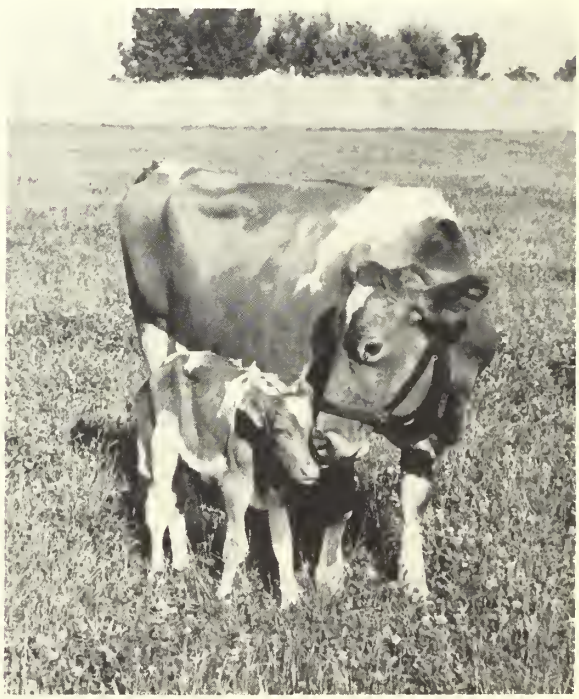
DESIGN AND ILLUSTRATIONS by Graphics Section Bureau of Reclamation, Washington, D. C.

J. J. McCarthy, Acting Editor

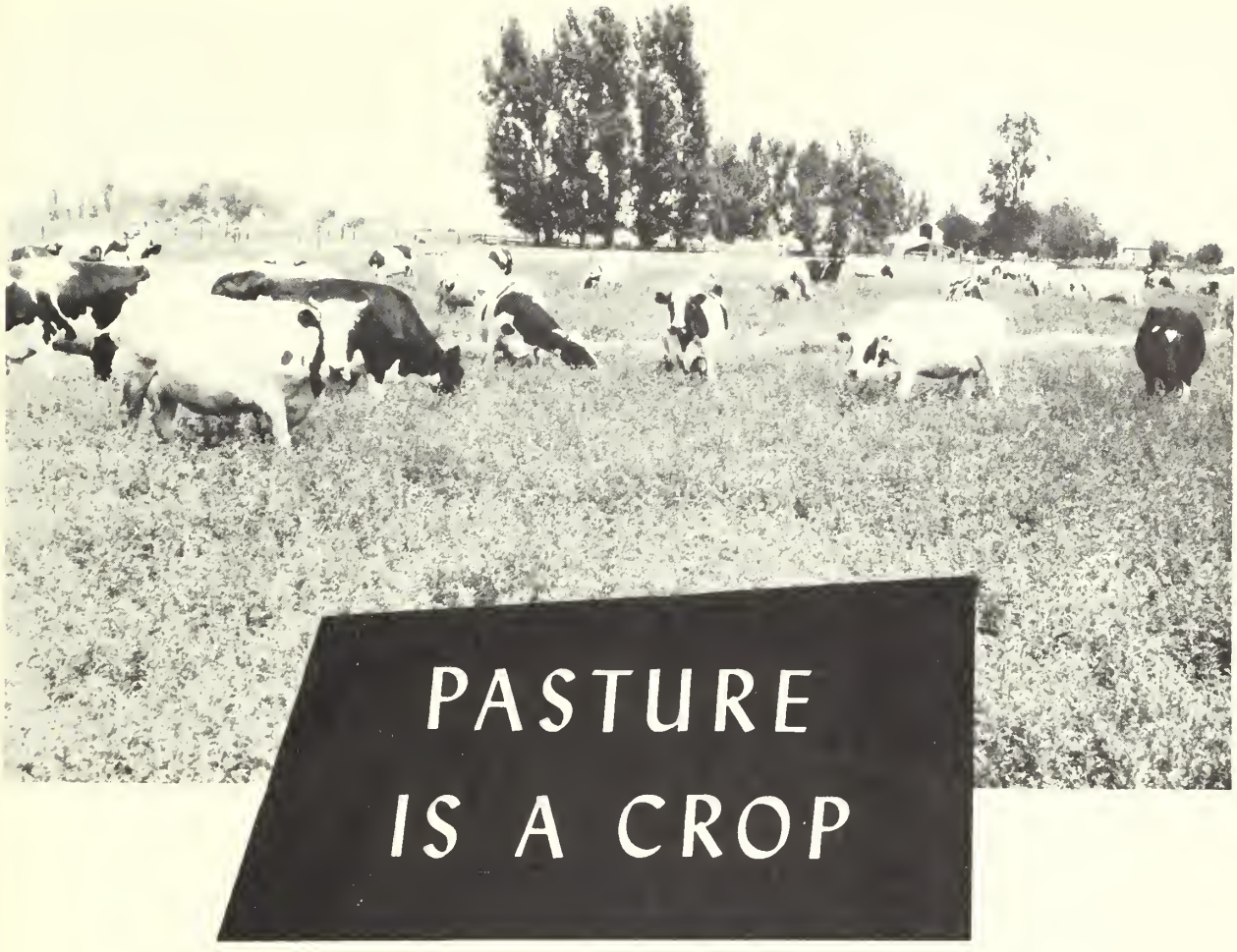
Issued quarterly by the Bureau of Reclamation, United States Department of the Interior, Washington 25, D. C. The printing of this publication was approved by the Director of the Bureau of the Budget, May 5, 1953.

Water is Wealth

In this issue . . .



DAIRY PRODUCTS PRODUCED ON IRRIGATED PASTURES are the backbone of the irrigation economy in the Boise Valley of Idaho. *Photograph, courtesy University of Idaho Extension Service.*



by HOWARD B. ROYLANCE, Agronomist, University of Idaho Extension Service

Pasture is a crop and should be considered as such. The right kind of pasture produces more and cheaper feed for livestock than any other crop a farmer can raise. All livestock does better on good pasture. A poor pasture may actually be a liability. Not just any chunk of ground with green stuff on it can be called a good pasture. Too often it is a pasture in name only. Many times it would be better if the field were plowed up and put to some other use. In times of declining livestock prices good pasture is more important than ever. A farmer must get all he can from his acres.

Pasture as a crop is important enough that it deserves to be on good soil. However, the drawbacks of poor soil can be minimized by proper management of both the land and the livestock. The type of soil and its location should be taken into consideration in starting pastures. The grazing fields should usually be handy to barns and corrals.

Generally a mixture of grasses and at least one legume is desirable for an irrigated pasture in Idaho. Forage from such mixtures will be high in proteins and minerals and provide maximum yields during the season. As the growth of grasses slows down during the heat of the summer, the legumes thrive. The pasture mixture recommended by the University of Idaho for general use on irrigated land is 6 pounds of Manchar smooth bromegrass, 4 pounds of orchard grass, 4 pounds of alta fescue, and 2 pounds of ladino clover. That is the amount of seed for 1 acre. In places where irrigation water is not plentiful, a mixture of 6 pounds of Manchar smooth brome,

PASTORAL SCENE near Overton, Nev., exemplifies benefits of irrigated lands to desert areas.

6 pounds of crested wheatgrass and 2 pounds of Ranger alfalfa is recommended.

The first essentials for a good seedbed are firmness and availability of moisture near the surface. Spring tillage operations usually include plowing, disking, harrowing, floating, and packing. Early spring working is desirable to compact the seedbed, save moisture, and eliminate weeds before seeding.

Early spring is generally more favorable for establishing pastures than any other time. Seeding should be delayed, however, until danger of severe frost is over as clover seedlings are easily killed by cold. Late fall seedings are not usually successful because they are too readily injured by winter.

Drilling of seed is preferable to broadcasting, if steps are taken to make sure the seed is placed at a uniform depth not greater than 1 inch. Half an inch is better. A firm seedbed helps to control depth of seeding. When the mixture is to be seeded with a drill, the grass seeds should be seeded through the grain compartment of the drill. The clover should be seeded through the legume attachment. The use of rice hulls as an aid to seeding shows considerable promise. Enough seed for an acre is thoroughly mixed with a bushel of rice hulls and seeded through the grain box with the drill set at the rate of 75 pounds of wheat. This gives an even distribution and prevents bridging in the drill box. If a satisfactory drill is not available, the broadcast method may be used. In that case the seedbed need not be as firm, but it should be harrowed immediately after seeding to bring the seed in contact with moisture. Rolling helps to pack the seedbed and keeps moisture near the surface.

So the young plants will have every chance to firmly establish themselves, special attention must be given to irrigation. Apply water frequently enough to prevent surface drying of the soil. Pastures should not be grazed early the first summer. If conditions are favorable, there may be enough growth to permit pasturing toward the end of the season. If this is done, livestock should be removed early so the plants have an opportunity to make recovery before frost.

Even on established pastures grazing too early in the spring should be avoided. The carrying capacities of pastures will be greatly increased by

withholding livestock until grasses have made a growth of at least 6 inches. Too much grazing is the common cause of low carrying capacity of pastures. Overgrazing weakens the plants and causes them to be shallow rooted and low producers.

Pastures require an abundance of water. Systematic irrigation is necessary not only in establishing a seeding, but throughout the life of the pasture. Maximum production is obtained only when plants do not suffer from lack of water at any time during the growing season. Grazing while watering the pasture is damaging to the plants and should not be done.

The best way to fertilize pastures is to top dress with barnyard manure each fall. This practice, combined with proper irrigation, may result in increased pasture yields as high as 50 percent. Fall or winter applications of manure stimulate growth in early spring and through most of the season. Commercial fertilizers can also be used profitably. Most pastures will benefit from an application of 40 pounds or more of actual nitrogen per acre. Addition of phosphorus is desirable for growth of legumes.

Clumps of tall grass often surround droppings of cattle. They are not eaten and, therefore, reduce the carrying capacity. This loss can be avoided by using a spike-tooth harrow frequently to break up and scatter manure. Clipping of old bunchy growth not used by the stock will stimulate new, palatable forage.

Rotation grazing will aid in survival of pastures. It is desirable to divide pastures into three or more units. One unit may be grazed while the others are renewing their growth. This kind of management will provide better pastures throughout the season. This is desirable for high production of all types of livestock.

The use of a number of pastures rather than one, as in continuous grazing, calls for more fencing and more watering places. However, the increased returns more than justify the increased costs. # # #

ATTENTION ALL ERA READERS

This is a reminder that beginning with this issue the Reclamation Era will be issued quarterly.

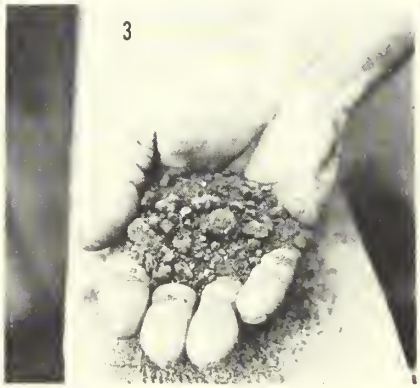
The next issue will be published in October. Please see inside front cover for details.

MOWING PASTURES (left) helps control weeds, keep an even sward, and control bloat. For this purpose mow about one-quarter of each pasture unit before turning in stock. Below, Drilling Ladino clover.

TIME TO IRRIGATE

Simple Soil Test Tells When To Irrigate

by C. H. DIEBOLD



1. Take typical handful of soil from a depth of between 6 and 12 inches. 2. Squeeze the ball of soil firmly three or four times. 3. If the soil is too dry to form a ball, it contains less than one-quarter as much readily available moisture as it would have when at field capacity. 4. Soil moist enough to form a ball contains at least one-quarter the amount of readily available moisture it would have at field capacity. *All photos in this story by John Land, SCS regional photographer.*

Editor's Note: Mr. Diebold is survey supervisor for the U. S. Soil Conservation Service, Albuquerque, N. Mex. The article is reprinted from "What's New in Crops and Soils" published by the American Society of Agronomy.

When do you need to irrigate? To what level should the "readily available" moisture in the crop root zone drop before you put on water?

For most row crops, you can delay irrigation for several days if the "readily available" moisture is more than one-half the total amount that can be held in the soil at a depth of 6 to 12 inches.

In contrasts, growth has slowed up and you have missed the best time to irrigate when the level of readily available moisture is lower than one-fourth in the 6- to 12-inch layer.

The best way to maintain rapid growth is to irrigate when the level of readily available moisture in the 6- to 12-inch layer is between one-fourth and one-half.

What is readily available moisture? It is the volume of water occurring between the moisture level, field capacity, and the level at which plants with mature root systems begin to show drought symptoms. It is the moisture that a plant can obtain easily from the soil while maintaining rapid growth.

We consider that a soil is at field capacity 2 days after it has been well-soaked by irrigation or by heavy rain. We say it is at the other limit when plants with well developed root systems begin to show signs of wilting. Readily available moisture, then, is the amount of water that a soil can deliver easily to plants between these two points.

We have calculated the readily available moisture values for the surface foot of various soils in the Southwest.

These values are based on irrigation trials, and they cover the common ranges of soil texture. They represent the average depth of water that can be held in readily available form.

2.1 inches per foot of soil for medium to fine textured soils.

1.2 inches per foot for sandy loams containing more than 70 percent sand and for loamy sands up to 85 percent sand.

1.0 inch per foot for loamy sands containing 85- to 95-percent sand.

0.7 inch per foot for sands—more than 95 percent sand.

As expected, sandy soils hold smaller amounts of readily available moisture than heavier soils. But, to our surprise, there was little difference between fine sandy loams (less than 70 percent sand), loams, silt loams, clay loams and clays.

Now, with this information, if you learn to estimate the percentage of readily available moisture present in the soil, you can then estimate the inches of water to be applied to bring the root zone to field capacity.

You can also better determine when the moisture content is suitable for tillage. Just because the soil is not sticky, don't think that you can operate without creating a tillage pan.

at the time of planting winter wheat may be the difference between success and failure. You can also evaluate different tillage and management practices as they affect storage of moisture in the soil.

The author has tried several methods of estimating readily available moisture over a period of years in New Mexico, Colorado, Utah, and Arizona. Of these, the "ball test" for estimating readily available moisture in medium to fine-textured soils appears to be the most practical.

A spade is perhaps the most satisfactory tool for examining the surface foot of soil. For deeper depths, a soil tube or an auger is helpful in taking samples quickly.

For the steps to be followed in estimating readily available moisture, please refer to the photos accompanying this article.

The same clues apply to the sandy soils except that the balls of soil are usually fragile for the entire range from one-fourth readily available moisture up to field capacity.

5. Toss moist ball about a foot into the air. 6. If the ball still remains intact after it has been tossed five times, it is durable. It will contain more than one-half readily available moisture. You won't need to irrigate at this level. 7. If the ball breaks with five tosses or less, it is fragile, and contains one-quarter to one-half readily available moisture. This is the best time to irrigate. 8. Ball is durable when moisture is at level of three-quarters of field capacity. 9. If thickness of one-fiftieth of an inch, or more, sticks to your thumb after soil is squeezed firmly, readily available moisture is between three-quarters and 100 percent of field capacity.

Preliminary studies indicate that tillage pans may be created by most farm implements, when more than one-half of the readily available moisture is present in the soil. Of course, the one-way disk is especially bad in creating tillage pans, but don't overlook the other tillage implements.

Although this article is directed largely toward irrigation farming, the writer has found that estimating the percentage of readily available moisture present is helpful on dry farm lands also.

Here, the amount of readily available moisture

If you follow the procedures, you should be able to estimate within one inch the depth of water that you need to apply to fill the root zone. The ball test is a sound, proven guide for the farmer who wants to apply water efficiently. ###

SHAPING NEW DITCH at about 100 feet per hour, left. Above, removing moss and silt at rate of 1 mile per day per machine. *All photos by the author.*

SALT RIVER'S PROBLEMS SIMPLIFIED

by D. W. NICHOLS, Chief Draftsman
Salt River Valley Water Users' Association

Editor's Note:

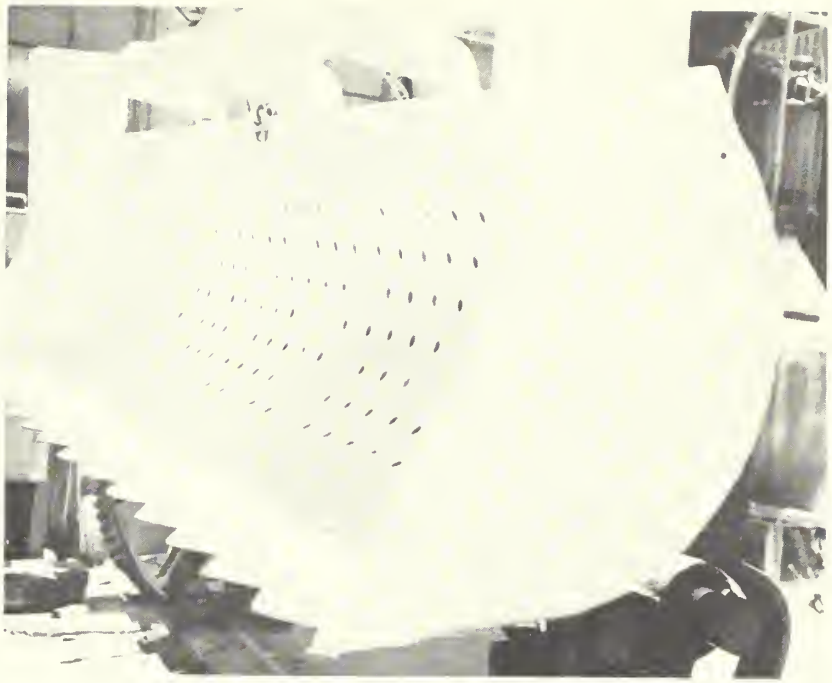
The equipment described in this article has been particularly useful in the Salt River Valley because of a large metropolitan area and rapid urban development within the project boundaries. As the author points out, the hydraulically controlled boom type excavating and grading machine is well suited to such conditions because of its movability.

Ditch cleaning, maintenance, and construction have been made easier for the Salt River Valley Water Users' Association by the addition of five hydraulically controlled boom type excavating and grading machines to their fleet of heavy equipment. These machines have proven themselves to be more than adequate to perform economically such jobs as ditch cleaning, ditch shaping, canal demossing, excavating, truck loading, setting tile, and many other smaller jobs. They are especially adapted to trimming and grading canal banks in preparation for gunite lining. They work with equal ease from either the canal bank or the canal bottom, and grade within tolerances that normally would be expected only from hand labor.

Two new types of buckets were made in our shops for use on the machines, and more special purpose tools are in the making. One bucket, used for demossing canals and laterals, is shaped somewhat similar to the 60-inch ditch cleaning bucket supplied by the manufacturer, but is 72 inches wide. It uses a hard-faced serrated cutting edge to cut the moss on the canal bottom, and the whole bucket is perforated to facilitate drainage as it is normally used under water.

A large amount of moss and some silt is removed with each pass of the bucket, resulting in about 1 mile of ditch demossed per day per machine. This work is done in conjunction with our regular method of demossing, which consists of teams or tractors dragging chains or a disk harrow through the canals and laterals. Temporary pipe grates are placed in the ditch downstream from the demossing crew (usually at a check structure or a culvert), to retain the free floating moss. As the moss gathers on the grates, it is removed with hand rakes, and deposited on the ditch bank for removal. Where the use of the machine is more applicable for demossing and cleaning, the costs average approximately $68 per mile, which is about one-half the cost of demossing with chains or disk harrows.

Another advantage of the grading machine is on ditches where, due to physical characteristics, namely, lack of maintenance roadway right-of-way and accessibility for tractors or teams, hand



DEMOSSING BUCKET uses hard-faced serrated cutting edge to cut moss on canal bottom, and the whole bucket is perforated to facilitate drainage as it is normally used under water.

demossing was necessary after drying the particular ditch. The use of the machine in these ditches results in considerable saving of time and reduction of water loss, since this method does not require a dry up.

A further advantage of the machine in demossing is the fact that a cleaning operation is incorporated along with the demossing, thereby eliminating an additional pass through the ditch with the hand crews at a later date.

Various machines and devices have been purchased and built in our shop to assist in the cleaning and demossing of ditches, but have not met with the success that has been obtained with the hydraulically controlled bucket operation.

Another bucket, used for shaping ditches preparatory to gunite lining, has proved to be as successful as the demossing bucket. Like the cleaning bucket, it varies in design from the manufactured attachment. By turning the cutting edges slightly outward and downward, closer control and ease of operation was accomplished. Several of these buckets were built with varying bottom widths and with wings extending upward on a three-quarter to 1 slope to conform to the desired ditch section. These buckets have a capacity of about ⅓ cubic yard and are equipped to utilize the standard hydraulic bucket hook up.

In operation the machine travels over the center line of the new ditch, digging and shaping to the desired grade. There remains very little hand work to be done after the shaping operation, which proceeds at about 100 feet per hour.

In the event the old ditch is to be lined, it is first backfilled, compacted, and reexcavated. There are several advantages to this procedure. First, the excavating machine can travel over the center line of the ditch making its cut with a series of passes, always parallel to the center line of the ditch. This results in a very straight trench free of the variations in alignment found in ditches excavated by other methods.

Usually the required ditch section is somewhat smaller than the existing ditch to be lined. Considerable savings in space and materials can be made by backfilling. Another advantage is a uniform ditch section. Since the buckets were made to conform to the desired ditch section, the bottom width, top width, or side slopes, cannot vary. The resulting ditch is straight and uniform, and must be seen to be fully appreciated.

The economy of this operation is outstanding. Comparing to the previous method of excavating with a dragline and finishing by hand, the hydraulically controlled machine does the job *better* and *faster*, and without hand finishing at about one-fifth the cost. Excavating, shaping, and finishing averages about 22 cents per cubic yard, or about 11 cents per linear foot of ditch.

Although the machine is unexcelled at preparing

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"FARMERS' TOWN HALL"

The farmer in the fields of the Columbia Basin project moved into the "town hall" for an afternoon this winter, and the consensus of both the Bureau of Reclamation and the farmers is that the move was "excellent."

The purpose of the meetings was to let the farmers bring up the questions about irrigation in this 1,029,000-acre project that started large-scale development in 1952.

Meetings were called on different days by each of the three Columbia Basin project irrigation districts—the Quincy-Columbia Basin, East Columbia Basin, and South Columbia Basin.

The presidents of each of the districts presided at their respective meetings—Don Damon for the East District, Jake Weber for the Quincy District, and Loen L. Bailie for the South District.

Bureau of Reclamation officials on the project were invited to "sit in" at all meetings to answer questions and to explain the procedures followed in operating and maintaining this project.

In the words of E. H. Neal, supervisor of O. & M. for the Bureau of Reclamation, the meetings "helped a lot."

"The small sore spots that come up in the course of any season don't get a chance to become boils," he points out.

Representatives of the Land Development Branch of the Project Development Division, which operates the five development farms on the project, attended all meetings to answer questions on types of soils, crops, and fertilizers tested by State and Federal agencies.

The Land Division sent representatives to answer questions about leases and rights-of-way.

Among the questions discussed were development period operation and maintenance charges, land classification, water allotments and waste water.

It was explained that the cost of water is set to charge higher amounts for excessive use to protect the land from overirrigation.

Some of the older line irrigation farmers answered the very questions raised by some of their neighbors—by telling them how much water it should take to irrigate a given field.

"We exchanged information at the grass roots level," Neal reports, "and that means everything in a project as big as ours. This year we were dealing with a thousand farmers, but before development is complete, we'll do business with 14,000. If we can keep this grass roots approach, we'll go a long ways toward making a success of relations between the settlers and the Bureau on the project."

In this connection, Neal hopes that meetings can become annual get-togethers at which the settlers express firsthand what's on their mind and get the explanations directly at an open session sponsored by their irrigation districts. ###

YOUR MAGAZINE

Are there particular types of articles which you would like to see in the ERA that we have not printed to date? If so, please let us know, and we shall do our best to comply with your wishes.

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open ditches, it is by no means idle when a ditch is to be replaced by concrete pipe. By traveling down the center line of the pipeline location, it can trench with the same ease that makes it so adaptable to ditching. Speed and economy are not sacrificed by using the light, highly mobile machine, as it has proved itself to be a fast, economical trencher. In fact, it can boast of many advantages. Working in tight places, in trees or around power poles and other obstructions is a specialty of the machine. It uses a telescoping boom, and requires no elbow room or overhead boom clearance. Under normal operating conditions, no concern must be given overhead obstructions as low as 12 feet. This eliminates the danger of contacting power lines.

Work is always done at the end of the boom, eliminating the danger of swinging buckets or loads. By the addition of a close-coupled pipe hook, the machine becomes an excellent pipe setter. It can spot concrete pipe with speed and accuracy without sacrificing safety and can backfill the trench over the newly laid tile using standard attachment supplied by the manufacturer.

The machine has its advantages in truck loading. Close control on both cut and dumping can be maintained, and its loading cycle is quite rapid. It can work in the pit or from the top, or from on top with the truck in the pit.

In general, much can be said for the machine. It is fast in operation and on the road (55 miles per hour). It is as maneuverable as any 10-wheel, 193-inch wheelbase, tandem drive truck. It requires only 10-foot clearance, and weighs only 32,450 pounds. It has ample power (65-horsepower machine—106-horsepower truck). Its lifting capacities are 5,000 pounds with boom retracted, and 1,600 pounds with boom extended.

We are sure we haven't discovered the full extent of the machine's usefulness, for we are planning new methods and new tools and attachments to increase the versatility of this already versatile machine. ###

Australian Hydroelectric Chief Grateful for Reclamation Engineers' Help

Snowy Mountains Hydroelectric Authority Commissioner William Hudson, addressing the Australian electrical industry convention at Canberra early in May, said that the Snowy Mountains project—the most outstanding engineering project in Australian history—would be to a great extent a monument to the personnel of the Reclamation Bureau.

Mr. Hudson said it would be impossible to assess the value of the contribution made to the project by the Bureau of Reclamation, which he described as "one of the outstanding examples of farsightedness in the world's history." The Bureau has probed the whole world for information on all aspects of water conservation, hydroelectricity generation and flood control, and amplified this with knowledge gained in its own work over many years.

In addition, Mr. Hudson said, Reclamation was permitting engineers from the Australian project to work side by side with its engineers on great American projects, thus giving them experience they could gain in no other way. It was his aim, he added, that every senior engineer of the Snowy Mountains project should have the benefit of working with the Bureau of Reclamation engineers.

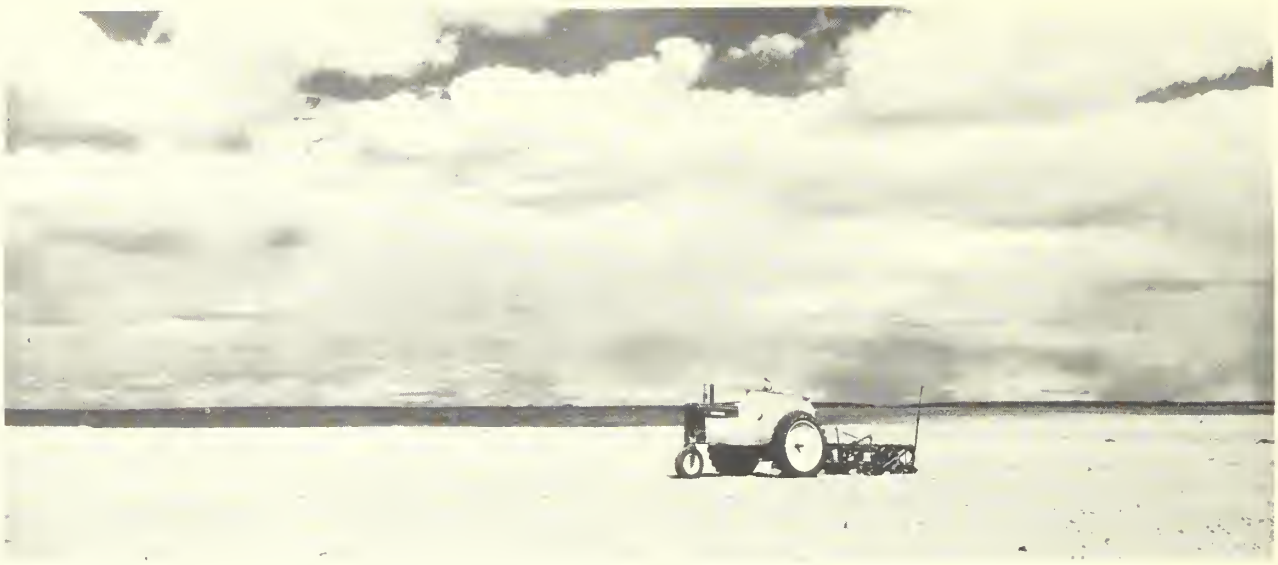
The Snowy Mountains project of southeastern Australia is now in a major construction stage. In a review of the project, Barbara Ward, former assistant editor of the London Economist, said: "When America finished the Tennessee Valley Authority it caught the imagination of people everywhere and they came from all over the world to see it.

CALIFORNIA PROJECTS ORGANIZATION

Secretary of the Interior Douglas McKay recently announced that the Bureau of Reclamation's Region 2 in California was to be discontinued July 1.

He announced a California Projects organization with headquarters at Sacramento to administer the Central Valley, Cachuma, Solano and Orland projects in northern California and the Klamath project, California-Oregon. Clyde H. Spencer, a Reclamation career employee of 34 years' experience, was appointed supervising engineer. Spencer's most recent job was construction engineer, Hungry Horse Dam, Mont.

Secretary McKay stated "that the work of the Bureau of Reclamation in California will go forward without interruption and in accordance with appropriations now being considered by Congress." Richard L. Boke, resigned as Director of Region 2, effective June 30.



NEW INDUSTRY IN THE COLUMBIA BASIN

LARGE-SCALE IRRIGATION in the Columbia Basin project will result in many new large industries in the project area. The first of these is the sugar-beet industry. The above photo, typical of land in the Moses Lake area of the Columbia Basin project, part of 6,000 acres were being planted to sugar beets this spring. This is almost double the 3,288 acres planted to the crop in 1952. This year's harvest will be refined in a new $9,000,000 sugar plant (photo below) now under construction.

The average yield last year for sugar beets in Columbia Basin was approximately 22 tons per acre, compared to the 14 tons national average. Both photos were taken by F. B. Pomeroy, region one, headquarters Ephrata, Wash.

NORTH FACE OF MAJESTIC SCOTTS BLUFF (background) AND NORTH PLATTE RIVER IN SCOTTS BLUFF COUNTY, NEBRASKA.

THE DESERT TAMED

by

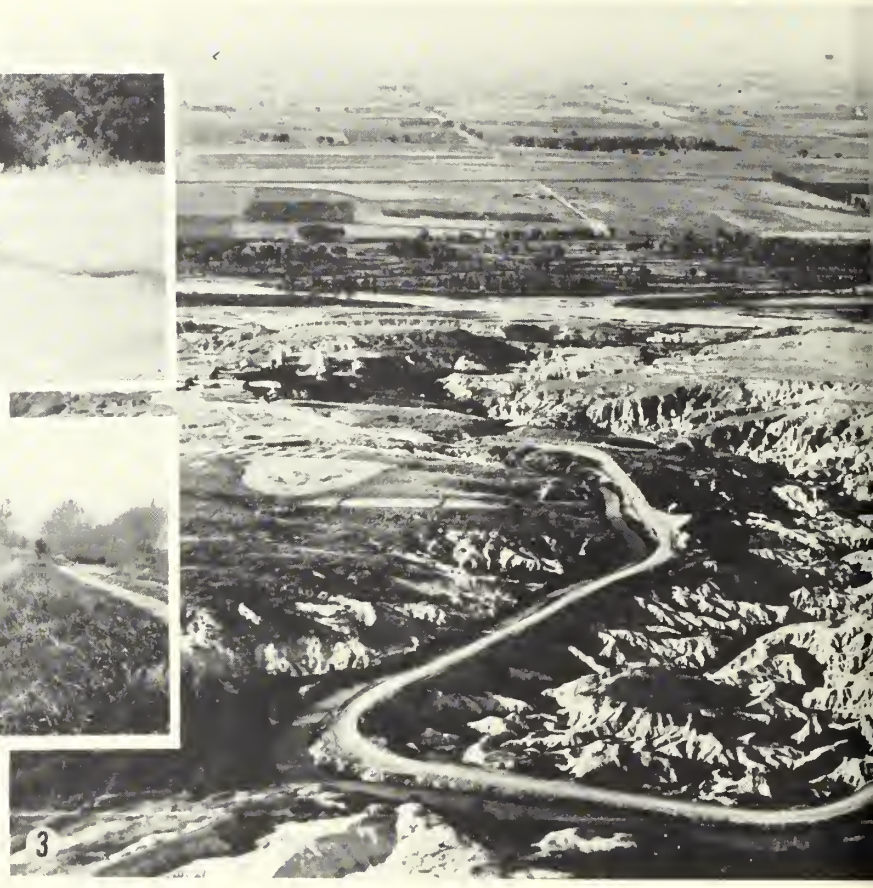
Antoinette H. Sands

Author's Note: The following article, covering a phase of the development of early irrigation in the North Platte Valley, is affectionately dedicated to my father, the late Frank M. Sands of Gering, Nebr., and Denver, Colo., who is the "engineer" mentioned in the sketch. He was often referred to by his friends and associates of the early days as the "Desert Tamer." Former Reclamation Commissioner Harry W. Bashore, Arthur B. Reeves, and the late Andrew Weiss were the engineers in charge of the construction of the Gering-Fort Laramie Canal as a part of the Bureau of Reclamation's North Platte Project. In a recent conversation with Mr. Reeves, he told me that he well remembers when Mr. Sands spent several days at their camp, consulting with them on the "puddling process."

LIKE A DANCING DERVISH the west wind came howling through Mitchell Gap, swept up into dust clouds the loosened earth of the prairie, pulverized by the restless feet of grazing herds, and in a wild fury descended upon the beautiful Gering Valley. Heedless of the curses of the early settlers and the plaints of their long-suffering wives, these two, the dust and the wind, wreaked their havoc. And the big, black cloud that had hung in the western sky for hours, giving promise of rain, ended in just another 3-day blow.

The broad North Platte river flowed in all its grandeur along the north side of Gering Valley. Picturesque bluffs, majestically headed by Scotts Bluff jutting up to the river with badlands at its foot, encircled it west and south, tapering into a low lying ridge paralleling the river. From symmetrically formed Dome Rock, standing out from its fellows like a sentinel, looking north across the river and to the east, the view was unbroken until the blue, western sky touched the curve of the earth.

Encouraged by the promise that the spring rains gave, the early settlers enthusiastically planted. But year after year their hopes were blighted when the green of their crops became parched and brown by early July and field after



1. Gering headgate, early days. 2. Gering ditch around Gering valley. 3. Badlands, showing present Gering ditch, still in operation. 4. One of Frank M. Sands' farms. 5. Beets taken from his farm after irrigation. 6. Irrigating beets. *All photos courtesty of Author.*

field went down under the withering sun and the devastating dust storms.

After several seasons, heartsick and beaten, many deserted this capricious land and returned to their former homes back East. But a handful struggled on.

To the west, in Mitchell Valley, the inhabitants had developed a very creditable irrigating system. But for Gering Valley, Scotts Bluff with the badlands at its foot, formed a beautiful but defiant barrier to so simple a ditch-making scheme. To a visionary few it could be seen that by enlarging the Mitchell ditch, bringing the water from as high as its headgate, then across the 6-mile extent of badlands and into the valley, irrigation could be accomplished.

But those challenging badlands! There must be cuts, there must be fills, and in those days there was no huge, motor-driven machinery—the puny strength of men and horses, the only power.

Headed by one of this number who had a knowledge of engineering, the undertaking was physically entered into the summer of 1898. A nucleus had high hopes, many were skeptical, others openly antagonistic, maintaining that it was a "cow country" and that nothing else could be made of it.

That fall the Swanson fill across the first small canyon was completed and the work was being pushed on into the rough region beyond. The formation of these badlands is a peculiar shale known as "hardpan" and when blasted and exposed to the elements crumbles into a flourlike dust. The savage fall and winter winds turned the ditch camps into choking infernos, temporarily blinding horses and drivers. As the load of the two-horse slip or the four-horse buck-scraper was dumped over the edge into the yawning chasm below, it seemed that half of it was caught up by the demon winds and only a pitiful spoonful reached the bottom.

That winter was the severest the early settlers

had ever known. Many mornings the mercury stood at 40° below zero, congealing the spirit as well as piercing to the very marrow of the bone. Raging blizzards were borne in upon the wings of the wind, overcoming all but the hardiest. Still the work was pushed forward. By spring the first big fill, the Vickery, was finished. The water was diverted over the Swanson wasteway while the last scraper load was dumped to complete those high banks. A small head of water was then turned down the new ditch. It crept along, soaking into the newly cut earth, over the minor fills. Slowly it went as though feeling its way onto the white dust of the big fill. For 3 days this small amount of water was allowed to seep over the new work. The anxious watchers did not leave it day or night.

More water was turned down and another week's test given. The tension began to lessen. The keen concern wore off. The fill was holding. Farther on the work upon the next big fill was being started. But the Vickery fill must carry more water than this. The check was opened wider. The sides of the ditch were fully soaked, the new head moved with a more positive motion, faster. It was a volume of water. It reached the fill, rushed across, but the additional heft was too great, the pressure too severe. The treacherous hardpan melted. The taxing winter's effort was ruthlessly washed away.

Undaunted, immediately a bigger crew of men and horses were put to work to rebuild the fill. It was completed by late summer and again that painstaking test—the gradually increasing amount of water, the lengthening period of soaking. With a good volume it held. When an approach to the maximum was turned in, it held for a short time. But again the treacherous hardpan crumbled beneath the weight and wash.

The high hopes of the early settlers were turned

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RIO GRANDE'S WEED CONTROL PROGRAM

by F. D. Postle, Former Irrigation Superintendent, Rio Grande Project Ysleta Branch, New Mexico-Texas (Now of Oklahoma City Planning Office), Region 5 (Headquarters at Amarillo, Tex.)

The Rio Grande Irrigation Project in New Mexico and Texas has long recognized the need for effectively controlling weeds and woody plants on project rights-of-way and in ditch channels. However, because of economic conditions and emergency restrictions for the last 20 years, which strictly limited funds, equipment, materials and manpower, an effective weed-control program was not initiated until 1948.

Various methods to control weeds, i. e., mowing, burning, grazing, spraying with fortified oils, hormone-type herbicides and hydrocarbons, plus soil sterilization to attack the more aggressive types of noxious weeds, were utilized on the project.

Parrot Feather (Myriophyllum Proserpinacoides) had infested three of the Ysleta Branch's larger drain channels to such an extent that the water surface was entirely hidden from view at many points. The choking effects of the plants raised the water surface elevation as much as 3 feet, and this condition jeopardized the productivity of adjoining lands.

Cattails (Typha latifolia) first infested the entire open-drain system. Later they began to invade the canals and laterals at an alarming rate. The cattails also created large berms. By midsummer 1948, the capacity of the smaller laterals was reduced as much as 50 percent and the entire irrigation schedule was endangered.

Willows were growing along 157 miles of ditches in stands varying from sparse to heavy. The willows interfered with maintenance work and the transpiration resulted in heavy water losses. Practically every mile of right-of-way was infested with Johnson grass.

Equipment selected for the weed war included two farm tractors with mower attachments. One tractor was a Ford-Ferguson, with a special pitman that was made in the Branch machine shop. The sickle was extended so that it could cut down the inside ditch slope while the wheels remained far up on the ditchbank. The other tractor was an Oliver-Davco, with a hydraulically operated sickle that would cut extremely heavy weeds and woody plants.

For spraying and burning, a model 4110 MT bean sprayer was chosen. The 200-gallon tank motor, pump and agitator were mounted on a 1-ton truck. The boom of ¾-inch steel tubing, supported by a truss, is constructed in sections, which

PARROT FEATHER covers drain from side to side in many places on Rio Grande project. Cattails, Salt Cedar, and willows can also be seen in this photo, taken by Fred S. Finch, Region 5.

allows a reach of 14 to 25 feet from the edge of the truck bed. A spray bar 90 inches long with 6 disk type Myers Monarch nozzles and $\frac{3}{16}$-inch openings, spaced on 18-inch centers, is attached at the end of the boom so that it can be set at any angle desired. The boom is mounted on a standard with a universal joint which fits into a socket on either side of the truck bed. Replacement of the Monarch nozzles by Delco No. 12 tips converts this sprayer to a burner. For spraying only, an 800-gallon tank sprayer with motor-driven compressor and a horizontal paddle-type agitator mounted on a 2-ton flat-bed truck was purchased. An E and E collapsible 3-sectional 32-foot hydraulic boom is mounted on the right side of the truck near the cab. The boom is adjustable so that the 3 sections can be raised or lowered to fit ditch conditions. Also, each section of the boom is individually controlled from the sprayer allowing spraying from any or all sections at the operator's convenience. In addition, the operator can rotate the boom horizontally, either backward or forward for convenience in passing objects. The boom folds into a triangle and rests upright against the side of the truck for transportation. Most any type of nozzle can be used and spaced as desired. The Branch in addition has two 50-gallon capacity oil burners equipped with pumps and regulators which can be trailed or mounted in a pickup and used for spot spraying or burning. These are particularly valuable in treating isolated clumps of Parrot Feather.

After many check tests the following combination of methods has been adopted as standard in control of Parrot Feather in the Ysleta Branch drains: With the growth at its peak and water surface elevation at its highest (July through September), the drain is cleaned by a dragline. In early December, returning growth is sprayed thoroughly with either 27 burner oil or 32 Diesel oil fortified with 1 quart of 50-percent pentachlorophenol per each 100 gallons. A patrol is made in 45 to 60 days and from that time patrols are made at 90-day intervals, using the same spray formula. The average cost of Parrot Feather control, following cleaning, during 1950 was $17.44 per mile over 22.34 miles, for 1951 was $17.10 per mile over 44.39 miles, and for spot spraying required during 1952 was $5.11 per mile. The cost of draglining prior to use of oil spray methods was over $200 per mile. In no treated drain has return growth amounted to more than a minor fraction of 1 percent.

In control of bank weeds all brush is carefully cleaned from the inside slopes and top of banks by mowing, slashing or blading during the winter maintenance season and good operating roads are prepared. When new growth or shoots are fairly well started in the spring, and before new crops are through the ground, a spray consisting of:

Sodium salts of 2,4-D acid equivalent	1½ pounds.
Triton X–100	1 pint.
Diesel fuel oil	5 gallons.
Water	95 gallons.

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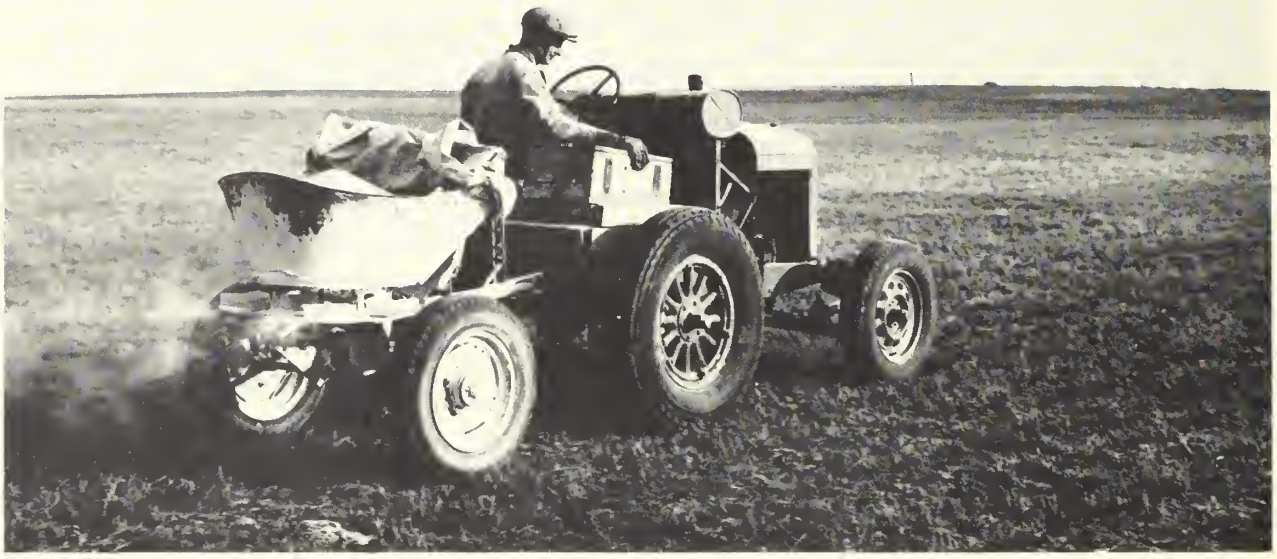
BUTANE-PROPANE burner clearing grass and weeds from lateral banks (at right). Below: Spraying weeds with fortified oil on Franklin Canal, Rio Grande project. *Both photos by J. G. Koogler, Region 5.*

Fertilizer Facts



ARLEY DELP on his Yakima Roza farm found spots wilting in his alfalfa field. Upon his request Bureau of Reclamation representatives made investigation and found land needed phosphate. ***Photo by Wayne Fuller, Region 1.***

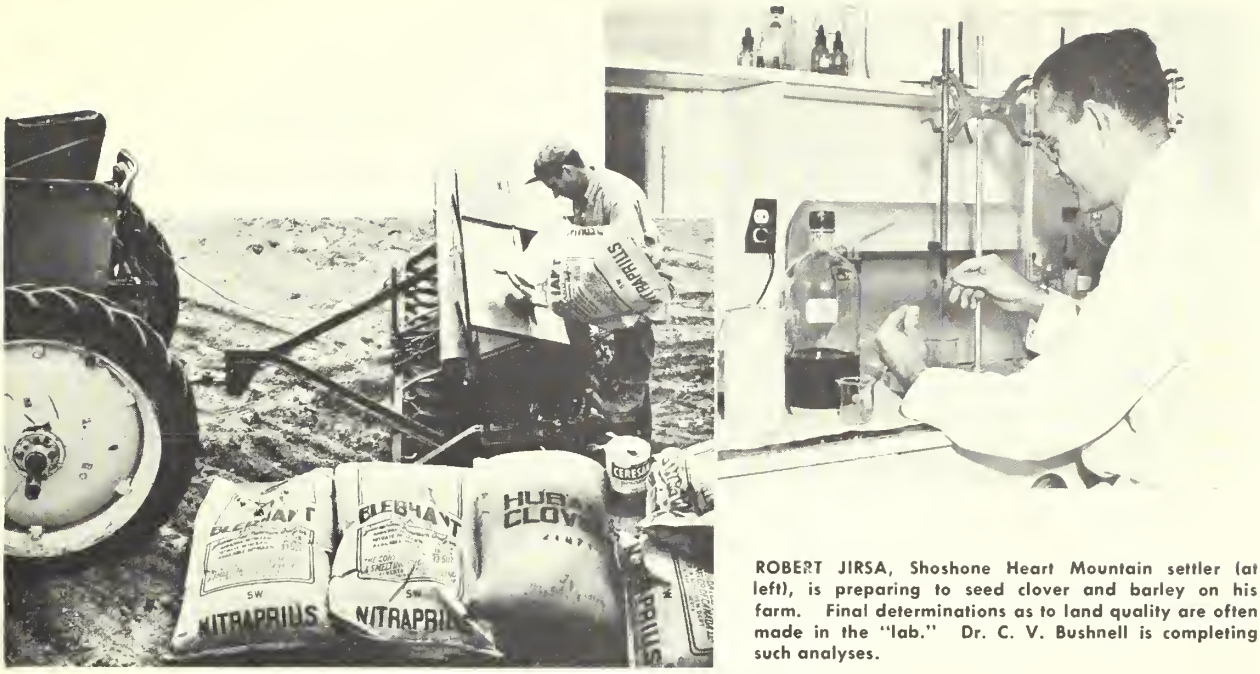
by J. V. BRIGGS,
Owyhee County Agent,
Owyhee County, Idaho

It is surprising to realize how many misconceptions there are about fertilizers. Many questions are being asked by farmers in relation to the soil-testing work done by the county agent. Ninety-eight soil samples were analyzed during last January and February. Each sample is tested to determine the amount and type of salts and available phosphate present. The test also determines the organic matter content which indicates the potential nitrogen level.

Most farmers want to know what fertilizers will be needed for maximum crop yields. The soil test is a reliable measure before crops are grown.

Starting with first things first, it is important to take the soil sample properly. Instructions are simple: using an irrigation shovel, spade out a V-notch in several places in each sample area. Slice off 1 inch of soil from one side of the V-notch and cut a strip 1 inch wide in the center of the soil slice. This will leave a cube of dirt 1 by 1 by 6 or 7 inches long, depending upon the size of your shovel. Place this cube in a container and secure as many more as will give a true average, composite sample of the field. Place these samples in a clean sack or on a canvas dam, and thoroughly mix. Take about 1 pound from the soil sample and place it in a labeled container, indicating the field area and deliver it to the county agent. A sketch of the farm, indicating the cropping history of each field and the general characteristics of the farm, should accompany the samples.

Barnyard manure is valuable because it is the cheapest source of plant food. A 10-ton application of barnyard manure properly handled will supply approximately 126 pounds of nitrogen, 42 pounds of phosphate, and 92 pounds of potash. Barnyard manure not only is the cheapest source of plant food nutrients, but it supplies the humus and organic matter needed to allow the water to penetrate the soil, making the plant food available to the plants. In soils lacking good tilth, the soil will run together, bake, and cut off the oxygen that is needed by the micro-organism and bacteria found in the soil. Without these soil organisms and bacteria liberating the plant food nutrients, reduced yields will result.



ROBERT JIRSA, Shoshone Heart Mountain settler (at left), is preparing to seed clover and barley on his farm. Final determinations as to land quality are often made in the "lab." Dr. C. V. Bushnell is completing such analyses.

Judging from the majority of these soil analyses, we can safely say that most farms need more fertilizers than are provided. Soils lacking certain nutrients can be supplemented by commercial fertilizers if barnyard manure is not available. Returns from the use of these fertilizers are large enough in some instances to make purchases of commercial fertilizers economically sound. When used correctly, they show a definite profit. Soils may be improved when barnyard manure and proper commercial fertilizers are used. The land will remain more productive if a good crop rotation plan is followed. Wise buying of commercial fertilizers is important if the fertilizers are to return a profit for the investment and the labor involved. Being able to supply your soil with the proper fertilizer may depend entirely upon your ability to buy commercial fertilizers wisely.

First you may need to know the symbols for some of our plant food nutrients. It pays to know all we can about anything we buy. The most common food nutrients are nitrogen, phosphorus, and potash. The symbols for these nutrients are: N for nitrogen, P_2O_5 for phosphorus and K_2O for potash. In all "straight line" formulas, these three always come in this order: N, P_2O_5, and K_2O.

The percentage composition of fertilizer is simply the percentage of each plant nutrient which that particular brand guarantees. Remember, the first figure is for the percentage of nitrogen, the second is the percentage of phosphoric acid, and the third the percentage of potash. Thus a 10–16–8 fertilizer contains 10 percent nitrogen, 16 percent phosphoric acid, and 8 percent potash. The percentages may change with the various brands of fertilizers, but the order of nutrients does not change. A "simple" fertilizer contains only one of the nutrients. They are written in straight line formulas, but there is only one figure above zero; therefore, a simple fertilizer is written 0–24–0, 20–0–0, 0–0–50.

Mixed fertilizers contain more than one plant nutrient. Examples 16–20–0, 0–20–30, and 16–0–30.

"Complete" fertilizers would have numbers above zero for the percentage of all three nutrients. Examples 10–10–5 and 4–16–4.

Your soil may need one or more of these nutrients to produce maximum yields. It may need nitrogen or phosphoric acid or it may need both. It usually costs $10 to $15 per ton to mix these fertilizers. It may pay to do your own buying of simple fertilizers and mix them yourself. It is not what we make, it is what we save that counts.

One precaution farmers should take in buying phosphate fertilizers is to determine the amount of available phosphate. It is the percent avail-

(Please turn to page 151)

MAN-MADE CAVERN is the Frenchman Hills tunnel, 16 feet in diameter, shown above. Puddle of water inside tunnel, at left, is hardly a forerunner of things to come, when enough water to irrigate 50,000 acres will pour through the structure. *All photos by Harold E. Foss, Region 1.*

FRENCHMAN HILLS' SAFETY RECORD

by HAROLD E. WERSEN, District Safety Engineer, Columbia Basin Project, Wash.

(Editor's Note: In building irrigation systems, engineers may tunnel through mountains or build canals around them. In building structures for the million-acre Columbia Basin Project of central Washington, they have done both. One mountain which the engineers have tunneled through is the Frenchman Hills, located 59 miles down the 88-mile-long West Canal. Through this tunnel, water will pass which is destined to irrigate ultimately 50,000 acres, among them some of the richest land of the project. The story of dig-

ging the Frenchman Hills tunnel, recently completed, set one of the finest safety records in the history of the Bureau of Reclamation.

On any major construction job you can figure on a certain number of injuries resulting from accidents. These may range in severity from very slight to fatal. When you build a tunnel through a mountain the hazards are even greater than on other construction jobs.

These facts long had general acceptance among this class of heavy construction workers, "the muckers," and "sandhogs," and the general public. But, the Frenchman Hills tunnel on the Columbia Basin project of central Washington, which is just short of 2 miles (9,280 feet) in length, has proven the fallacy of this idea.

When the tunnel was "holed through" in the evening hours of June 27, 1952, the safety record was among the best in tunnel building history.

Prior to the start of actual work on this contract during the previous summer, General Superintendent C. C. Harris, United Concrete Pipe Corp., and Ralph Bell of Baldwin Park, Calif., with the Bureau of Reclamation's Resident Engineer Fred McCune, Chief Inspector Ralph Howtrow, and District Safety Engineer Harold E. Wersen, held three preconstruction conferences.

All procedures of tunneling, kinds of equipment, and methods to be used were planned to eliminate the accident-producing factors.

The danger ran high, from the very start, as there were approximately 400 feet of compacted sand impregnated with big rock to bore through at both the inlet and outlet portal of the projected tunnel.

It was estimated that 350 tons of steel would be needed for support of the inside walls and ceiling, but it actually took more than 700 tons of steel to support the variable types of earth that were bored through.

There are only 1,671 feet of unsupported tunnel in the 9,280-foot length. The average daily advance through this length was 32 feet per day by three shifts, 6 days a week. The maximum advance in any 1 day was 62 feet.

Frenchman Hills tunnel had four injuries outside the tunnel. The most serious was the one in which a carpenter lost a finger on a cutoff saw. The other three were minor injuries representing 1 to 3 days off the job.

There were seven lost-time injuries inside the tunnel for a total of 64 days, making a total on the operation of 385 days. The carpenter's injury accounted for 300 days (based on standard scale of time charges) of this total.

All injuries inside the tunnel were at the heading. None occurred on equipment.

In comparison with the Bacon tunnel on the Columbia Basin project, near Coulee City, the Frenchman Hills tunnel represented much greater hazards because of the nature of the material the tunnel was driven through, although the length and diameter were somewhat less.

That good safety planning paid off is no question, when comparisons are made. Bacon tunnel had 93 lost-time injuries for a total of 1,361 lost-time days. Yet this was considered a good safety record for a job of such scope and danger.

From the standpoint of a safe job, we have been informed that the Frenchman Hills tunnel job sets a record in safety for the Bureau of Reclamation. This is a major tunnel job in which the cost is not measured in lives lost. ###

BIG ENOUGH for a car to drive through, THE FINISHED PRODUCT is 9,200 feet long and approximately 14 feet in diameter (16 feet when bored).

LOW COST IRRIGATION STRUCTURES

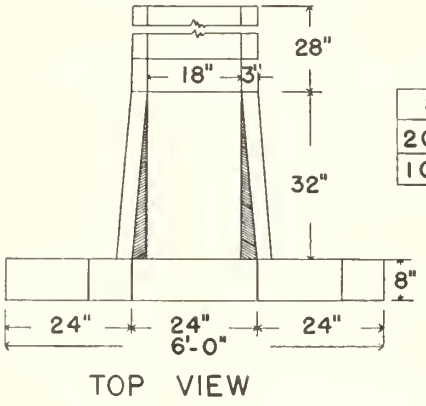
(Second of a series of three articles based on information contained in circular 122, a publication of the University of Wyoming Extension Service)

Proper irrigation structures offering efficient control of water can cut down soil erosion and water losses and help promote higher crop yields. Concrete structures, often thought to be very costly and difficult to install, are becoming more popular among irrigators, as improved techniques make them easier to install and much less expensive. Often they can pay for themselves through savings in time, soil erosion and water losses in only one season of operation.

A drop structure, which prevents water from moving too fast in the ditch bed and tearing away valuable soil, is a typical irrigation structure that can be made more efficient and durable through fairly inexpensive concrete construction.

Construction of a concrete drop is quite simple. A 6-inch concrete foundation is poured and a row of blocks put on the fresh concrete and worked into the concrete enough to secure a good bond. Succeeding rows of blocks are then mortared in until the structure reaches the desired height. The bottom of the spillway over the drop should be grouted in with concrete so that water will not run down through holes in the blocks.

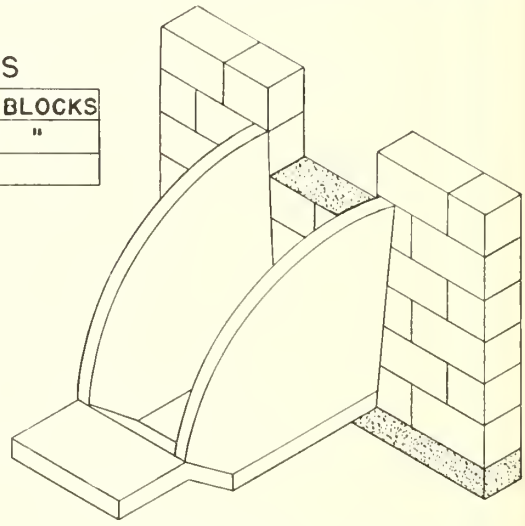
To reduce erosion losses to a minimum, it is important to install a stilling basin on the down-



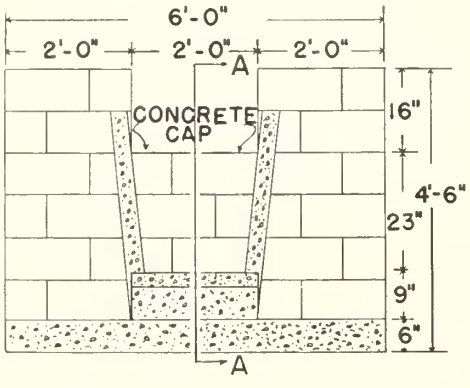
TOP VIEW

BILL OF MATERIALS

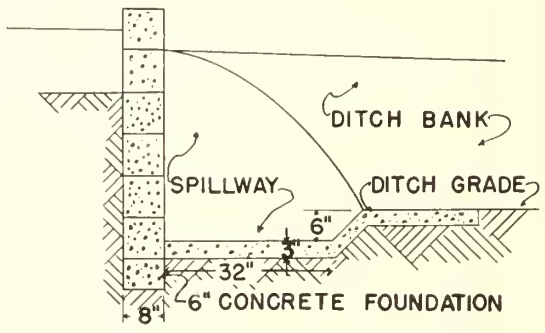
8 - 8"x 8"x 8"	CONCRETE BLOCKS
20 - 8"x 8"x16"	" "
10 CU. FT.	CONCRETE



ISOMETRIC VIEW



FRONT VIEW



SECTION A–A

Drop--Concrete Block

face side of the structure. The basin should be twice the length of the drop and about 6 inches deep. It can be made either of concrete or of rubble mortared together.

Blocks used in the construction should be of dense concrete, not the lightweight type. For best results, all concrete mixes should be 1 volume cement to 2¾ volumes of sand to 4 volumes of gravel, with a water-cement ratio of 5½ gallons per sack of cement. Mortar mixes should be of 1 volume cement to 2½ volumes of sand, or if hydrated is used then on a 1–1–5 ratio of cement, hydrated lime, and sand.

Cost of materials for the concrete block drop will average around $12.50. An overflow type of drop structure—as described here—is not so limited in its capacity as other types of drops, and it may be used as a check structure to take the water from the ditch running down the slope to a lateral. This type of concrete block construction, of course lends itself to the manufacture of various other kinds of drop and irrigation structures suited to particular needs.

If wood is used in the construction of such structures, it should be preservative-treated. # # #

(Continued from page 141)

to despair as they faced another winter, the ditch no nearer completion than the year before. Some were growing bitter. The "I told you so's" greeted the workers on every hand. Little children wished on the wishbone for the "big ditch to come."

During these discouraging experiences, the engineer had observed that when this peculiar flour-like shale was mixed with water and allowed to dry it partially regained its rocklike quality. From this he conceived the idea that by soaking the earth down in layers the fills could be made to hold. In spite of previous failures he was able to rally a few indomitable souls. With grim determination, amidst jeers and sneers from those who had no faith in his theory, the work was again gotten under way.

The following spring, with the exception of the major fills the ditch was practically finished, the small fills, the flumes and the excavating around the valley following the general curve of the hills.

As soon as the water could be turned down the Mitchell ditch that spring, the work on the twice-washed-away big fill was recommenced. The method was this: To bring the water as far as the works, to fill in a small amount of earth, then to soak it down with water, again the earth, and again the water and so on. This process became known as "puddling the fills." When this was found to work with complete success and the maximum flow of water was safely carried across on this almost-rock bed, the work was started on the next major fill. Since the work was dependent upon having water close at hand, only one fill at a time could be worked on and only during the summer season.

It was not until the latter part of the following summer, in 1901, that water actually flowed around the foot of Scotts Bluff and out into the ditch beyond. As this life-giving stream wended its way across those well-nigh unconquerable badlands, a lusty shout went up from the handful of poverty-stricken, weather-beaten pioneers—hope almost gone from lack-luster eyes, resignation to the inevitable plainly written on their faces. Tears were brushed from many a sun-parched cheek.

New hope had been kindled by the holding of the first big fill and the confidence of the workers. And since spring of that year the early settlers had been laying out distributing laterals. Much of this prairie was feeling for the first time the sharp share of the big four-horse breaking plow turning an 18-inch furrow.

Years later when the engineers in the Reclamation Bureau were working on the Gering-Fort Laramie Canal of the North Platte River project which headed miles up the river, reclaiming thousands of acres of this prairie land, were baffled by the instability of this hardpan in tunneling through this same range of bluffs, they were told to call in the engineer who had put through the Gering ditch—"he knew how to handle the damned dust."

The west wind still plays at will over the Gering Valley, but it now sweeps over broad acres of green alfalfa, waves the golden fields of grain, and rustles the sturdy rows of corn. The water taken from the bountiful supply of the North Platte River never fails to flow from the distributing laterals out over the fertile valley. And it doesn't matter now that the big, black cloud that hangs in the western sky for hours giving promise of rain, ends in just another 3-day blow. # # #

(Continued from page 143)

is applied in coarse droplets, using about 35 pounds per square inch spraybar pressure. This, in proportion to the density of vegetation, requires from 100 to 125 gallons per bank mile. Kill from this first application ranges above 90 percent for all plants except sweetclover and the grasses. A second application may be required in the late fall after crops have fully matured. The large acreage of cotton on the project precludes the use of 2,4-D in the summer. 1950 costs averaged $12.98 per mile, while for 1951 and 1952 they were $17.73 and $10.05 respectively for this phase of the work.

Once adequate elimination of willows and large bank weeds is achieved and good ditch-bank roads established, the control of cattails as well as of tules and other types of sedges becomes a comparatively simple problem. Undiluted 32 Diesel oil fortified with 50 percent pentachlorophenol, 2 quarts to each 100 gallons, applied generously in a coarse spray, using 35 to 40 pounds pressure through nozzles with 3/16-inch openings effects a minimum top kill of from 65 to 70 percent of these emergent waterweeds from the first application. Needless to say, all water should be cut off and the channel kept as nearly dry as possible for a period of 36 to 48 hours during and following treatment. Fifteen days later the water should again be drained from the channel to allow for a complete burning of dead canopy. In 2 weeks following the burning the green cattail and tule plants still surviving plus any new shoots are easily accessible and are subject to a repetition of the first treatment. In no instance has two spray applications followed by burning with oil failed to restore adequate channel capacity, but it has been necessary to repeat the procedure three and in one case four times to entirely eliminate those plants on the bank slope proper. Complete eradication of cattails has been obtained in 99 percent of the areas treated.

One striking result of the efforts to date is the rapid invasion of the areas formerly covered by willows by Bermuda, Salt and Johnson Grasses. Summer control was exercised through mowing and spraying with the same oil formula used on cattails, and by oil burning, with the immediate object of preventing rank growth and seeding.

Cost of spraying, burning, and mowing from 1950 through 1952 follows:

	Spraying		Burning		Mowing	
Year	Miles	Cost per bank mile	Miles	Cost per bank mile	Miles	Cost per bank mile
1950	71	$37.50	150	$9.25	559	$7.22
1951	278	21.55	341	7.46	228	9.18
1952	478	21.90	371	10.01	128	[1] 18.38

[1] In 1952 mowed both side slope and bank, required 2 trips per bank mile, ½ cost shown compares to costs for 1950—51.

It is believed that the adapted control methods are in the proper sequence to give most encouraging results with a minimum of lost motion and at reasonable costs under our conditions. ###

EDITOR'S NOTE: Since this article was originally submitted to the ERA in 1951 certain revisions were necessary before publication. These have been made by Mr. William C. Brady who succeeded Mr. Postle as irrigation superintendent.

Last Major Contract Let on Coachella Division All-American Canal Project

The last major construction contract on the All-American Canal project area in southern California has been awarded for completion of an 11-mile stretch of concrete pipeline in the Coachella Valley distribution system near Indio, Riverside County, Calif.

The Coachella Valley distribution system is designed to carry water to more than 74,800 acres of rich irrigated farmland from the 123-mile Coachella Main Canal which is a major branch of the integrated All-American Canal project. Construction of the Coachella Main Canal was completed in June 1948.

The All-American Canal project in its entirety serves 425,000 acres of rich desert land in southern California's Imperial Valley, which is one of the most productive areas in the world. The system, approved in 1928 as part of the Boulder Canyon project, includes Imperial Dam and desilting works, the 80-mile All-American Canal, and the Coachella Main Canal.

In 1952, the gross value of crops raised on the project areas totaled $112,608,511 of which $93,394,738 in crops were produced on the Imperial Division, and $19,213,773 on the Coachella Division.

The $519.45 per acre value of crops from the Coachella Division was the highest return from any of the Federal Reclamation projects in the 17 Western States in 1952. •

(Continued from page 145)

able to plants and not the total phosphoric acid present that determines its value. Some fertilizers sold to farmers are represented to contain 25 to 33 percent phosphoric acid but the guarantee analysis shows only 2 percent available. The comparative value of this material would be approximately $3 per ton compared with 43 percent treble superphosphate at $63 or 18 percent superphosphate at $27.

Soil fertility in the irrigated districts seems to be closely related to the physical condition of the soil. The fields in good physical condition are the ones that now are growing good crops. Soils with poor physical condition or soils that have been permitted to deteriorate so that water storing capacity has been lost show a corresponding decline in yields. The evidence is significant that continued use of barnyard manure or green manure crops or crop residues improve the physical conditions of soils. Ample food nutrients and good physical condition of the soil are the main factors necessary to produce high yields.

Four things—barnyard manure, green manure, crop residue, and commercial fertilizers are the means of maintaining fertility of soils. There are no other means. The first three provide both plant food nutrients and organic matter in varying amounts, while the fourth—commercial fertilizer—provides plant food nutrients only.

Where cash crops are grown, a building up of organic matter is slow. Maintenance of the present level requires care, and a deficiency, once permitted, is a tragedy which is difficult to overcome.

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LETTERS

Required Reading at Columbia

MAY 12, 1953.

BUREAU OF RECLAMATION,
Department of the Interior
Washington 25, D. C.

DEAR SIRS: I shall appreciate it very much if you will send me three (3) copies of the following which is being used as required reading for a course in economic geography at Columbia.

The RECLAMATION ERA, August 1951.

Sincerely,

JANET BOGARDUS,
Librarian, Graduate School of Business Library, Columbia University, New York 27, N. Y.

Thank You And Welcome Back, Mr. Trego

BLACKFOOT, IDAHO
Nov. 21, 1952.

GENTLEMEN:

I am a retired newspaper publisher, and I devote a lot of time to flood control and reclamation matters, including silt deposits in reservoirs, the way to reduce them; also the cause and cure of algae and silt lodging in canals and ditches and the cause and cure of moss forming in canals and ditches in warm weather.

These things all tie in together, and in this locality we have the whole grist in acute form. For 2 years I have been concentrating on the problems, and am ready to prepare a report just after the first of the year that will be of value to this locality and another report, an article more suitable to publish in a Reclamation magazine.

It seems to be quite a live subject, receiving considerable attention or creating anxiety, and I am asking whether I should prepare such an article for you, and if so should I accompany it with any photos of shore lines and disappearing bluffs on our American Falls Reservoir, our principal anxiety here.

In recent years I seldom see your publication and would appreciate being put on your mailing list again.

Yours truly,

BYRD TREGO.

DO YOU KNOW . . . .

- The original Newton Dam was the first irrigation storage dam in the State of Utah and possibly the first of Anglo-Saxon origin in the United States? It was built in 1871 using ox-drawn scrapers. Newton Dam, key structure of the Newton project in Utah, was completed in 1946 to replace it.

- Where you can find a reservoir on top of a reservoir? The City of Ogden, Utah, gets most of its culinary water supply from an artesian basin directly beneath the Pineview Reservoir of the Ogden River Project.

- That Parker Dam, with 235 feet of its structure below the Colorado River Bed, is the deepest dam in the world?

- That Davis Dam is named in honor of the late Arthur Powell Davis, one of the early Directors of the Reclamation Service (now Bureau of Reclamation), and father of the Reclamation development of the Colorado River?

- That the 1,400-mile-long Colorado River drains an area one-twelfth the size of the United States?

- That if the Grand Coulee Dam was divided up into souvenir pieces of concrete, there would be a 300-pound piece available for every man, woman, and child in the United States?

- That the Hungry Horse Dam got its name from two horses who were lost and were almost starved to death during winter of 1900–1901?

That the Hungry Horse Dam is the world's fourth largest and third highest concrete dam?

Bound Volumes of ERA

A few copies of volume 33 of the RECLAMATION ERA for the year 1947 are available at $2.50 a copy. These may be purchased by sending a check or money order made payable to the Treasurer of the United States to the Bureau of Reclamation, United States Department of the Interior, Washington 25, D. C.

NOTES FOR CONTRACTORS

Contracts Awarded During May 1953

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DS-3868	Davis Dam, Ariz.-Nev	May 4	1 13.8-kilo volt switchgear assembly for Davis Dam transmission system.	Monitor Controller Co., Boston, Mass.	$14, 37
DS-3885	Central Valley, Calif	May 20	7 vertical-shaft, turbine-type pumping units for pumping plants D1 to D6, inclusive, laterals 115.8W, 118.1W, 119.1W, and 121.0W, Unit 2, Delano-Earlimart irrigation district, Friant-Kern Canal distribution system, schedule 1.	Wintroath Pumps, Inc., Alhambra, Calif.	10, 37
DS-3885	do	do	14 vertical-shaft pumping units and two horizontal, centrifugal-type pumping units for pumping plants D1 to D6, inclusive, laterals 115.8W, 118.1W, 119.1W, and 121.0W, Unit 2, Delano-Earlimart irrigation district, Friant-Kern Canal distribution system, schedules 2 and 3.	Food Machinery and Chemical Corp., Peerless Pump Division, Los Angeles, Calif.	29, 67
DS-3886	Missouri River Basin, S. Dak	May 12	4 main control board additions for Huron, Mount Vernon, Sioux Falls, and Watertown substations.	Monitor Controller Co., Braintree, Mass.	22, 20
DC-3889	Central Valley, Calif	May 13	Construction of earthwork, pipelines, and structures, including pumping plants, for laterals 115.8W, 118.1W, 119.1W, and 121.0W, and sublaterals, Unit 2, Delano-Earlimart irrigation district, Friant-Kern Canal distribution system, schedule 3.	United Concrete Pipe Corp., Baldwin Park, Calif.	2, 588, 20
DC-3890	Missouri River Basin, Nebr	May 29	Construction of Bartley diversion dam	Foley Bros. & Anderson, Inc., St. Paul, Minn.	593, 45
DC-3891	Missouri River Basin, Nebr.-Kans	do	Construction of earthwork and structures for Franklin Canal and drains, schedules 2, 3, and 4.	J. D. Armstrong, Inc., Ames, Iowa	1, 152, 88
DC-3895	Columbia Basin, Wash	May 12	Construction of earthwork, piplines, and structures for area E-5 laterals, East Low Canal laterals, schedule 1.	Long Construction Co., Inc., Billings, Mont.	1, 798, 93
DS-3898	Palisades, Idaho	May 26	Structural steel, insulated metal wall panels, and accessory materials for Palisades power plant.	California Steel Products Co., Richmond, Calif.	189, 20
DC-3899	do	May 5	Construction of earthwork and structures for relocation of Idaho State Highway 29 (U. S. 26) from Big Elk Creek to Indian Creek, Palisades Reservoir.	S. Birch & Sons, Construction Co., Great Falls, Mont.	499, 62
DC-3900	Missouri River Basin, Nebr	May 29	Construction of earthwork and structures for Bartley canal, laterals, sublaterals, and drains.	Bushman Construction Co., St. Joseph, Mo.	1, 091, 07
DS-3902	Boulder Canyon, Ariz.-Nev	May 12	4 vertical-shaft, turbine-type pumping units for pumping plants L-4, L-5, and L-6, Coachella Valley distribution system, unit 8, schedule 1.	Fairbanks, Morse & Co., Kansas City, Mo.	15, 41
DS-3902	do	do	8 horizontal-shaft, centrifugal-type pumping units for pumping plants L-4, L-5, and L-6, Coachella Valley distribution system, unit 8, schedule 2.	Food Machinery & Chemical Corp., Los Angeles, Calif.	15, 38
DC-3904	Palisades, Idaho	May 25	Furnishing and installing 4 30,000-kilovolt-ampere vertical-shaft generators for Palisades power plant.	Pacific Oerlikon Co., Tacoma, Wash.	1, 977, 82
DC-3907	Columbia Basin, Wash	May 6	Construction of Warden, Warden relift, North Warden, EL61, EL61.7, and EL63.1E pumping plants, area E-5, East Low Canal laterals.	Commercial Builders, Inc., and Duncan Construction Co., Moscow, Idaho.	420, 67
DC-3909	Boulder Canyon, Ariz.-Calif	May 13	Construction of earthwork, pipelines, and structures for lateral 120.8 and sublaterals, part 2 of unit 8, Coachella Valley distribution system.	R. V. Lloyd & Co., Coachella, Calif.	595, 49
DC-3910	Cachuma, Calif	May 19	Construction of earthwork, steel pipelines, and structures for laterals 2 to 9, inclusive, Goleta distribution system.	J. E. Young Pipe Line Contractor, Inc., Los Angeles, Calif.	609, 86
DS-3911	Palisades, Idaho	May 29	4 186-inch butterfly valves for Palisades power plant.	Baldwin-Lima-Hamilton Corp., Philadelphia, Pa.	853, 25
DS-3912	Grants Pass, Oreg	May 15	2 16- by 7-foot top seal radial gates and 2 lots of embedded metalwork for Savage Rapids Dam rehabilitation.	DeLaney Co., Houston, Tex	20, 00
DS-3913	Colorado River Front Work & Levee System, Ariz.-Calif.-Nev.	May 20	11 lots of very-high frequency radio equipment for relay stations, schedule 1.	General Electric Co., Electronics Division, Syracuse, N. Y.	13, 734
DS-3919	Missouri River Basin, Mont	May 26	3 32- by 20-foot top seal radial gates for Tiber Dam.	Schmitt Steel Co., Inc., Portland, Oreg.	55, 025
DC-3922	Missouri River Basin, N. Dak	do	Construction of 1 115-kilovolt and 2 230-kilovolt switchyard approaches.	Orlando Construction Co., Coleman, Wis.	146, 766
DC-3924	Missouri River Basin, S. Dak	do	Construction of Winner substation additions	D. L. Varney, Inc., Omaha, Nebr.	13, 976
DC-3925	do	May 15	Construction of 20,000-kilovolt-ampere Rapid City substation.	Powerline Construction Co., Nashville, Tenn.	146, 311
DC-3930	Missouri River Basin, Mont	May 29	Construction of Crow Creek pumping plant and steel discharge line, schedule 1.	McClellan & MacQueen, Inc., Worland, Wyo.	120, 011
DC-3930	do	do	Construction of Toston and Lombard Canals and lateral and drainage systems ,schedule 2.	Langmo Construction Co., Milltown, Mont.	305, 055
100C-163	Hungry Horse, Mont	May 26	West Side Work Center	Flathead Building Service, Whitefish, Mont.	26, 473
117C-190	Columbia Basin, Wash	May 21	Drains and miscellaneous structures, area E-5	Long Construction Co., Billings, Mont.	58, 815
117C-191	do	May 27	Residences, garages and utilities, operation and maintenance housing at Ringold.	United Industries, Inc., Richland, Wash.	27, 525
200C-230	Central Valley, Calif	May 7	Clearing Nimbus Reservoir site	W. D. Zavalas, Oroville, Calif.	17, 800
300C-53	Parker-Davis, Ariz.-Calif.-Nev	May 11	Ten residences and 30 garages at Parker Dam Government Camp.	E. W. Scott, Adelanto, Calif.	112, 678
300C-54	Boulder Canyon, Ariz.-Calif.-Nev. (Boulder City Municipal Office).	May 26	Plant-mix resurfacing of streets	Ideal Asphalt Paving Co., Inc., Las Vegas, Nev.	28, 728
301C-4	Boulder Canyon, Ariz.-Nev.-Calif	May 12	Garage at Hoover Dam and foundation for oil and paint storage building at Warehouse No. 2.	Lembke Construction Co., Las Vegas, Nev.	13, 900
400C-40	Provo River, Utah	May 11	Water metering structure for Duchesne Tunnel, station 327-25.	Davis and Butler Construction Co., Salt Lake City, Utah.	17, 547

Construction and Materials for Which Bids Will Be Requested by September 1953

Project	Description of work or material
Boulder Canyon, Ariz.-Nev.	1 vertical-shaft, Francis-type, hydraulic turbine, 145,000 horsepower at 466-foot head, for unit N-8, Hoover power plant.
Central Valley, Calif.	Construction of Camino conduit involves 5.5 miles of 48- and 36-inch reinforced concrete pipeline, cylinder and noncylinder, or alternative steel pipeline and construction of 2,400 feet of 6-foot horseshoe-type concrete-lined tunnel, located near Placerville, Calif.
Do	Construction of north section of Madera distribution system's unit 3, part 2, requires 24 miles of laterals and sublaterals varying from 85 to 15 cubic feet per second capacity including checks, drops, road crossings, turnouts, division boxes, irrigation pipe crossings, and siphons. Work located 8 miles northwest of Madera, Calif.
Colorado-Big Thompson, Colo.	Grading landscape area, placing topsoil, and installing sprinkler system for system dispatcher's building 5 miles west of Loveland, Colo.
Do	Installation of public service 7,500 kilovolt-ampere transformer bank and 115-kilovolt Yuma bay at Beaver Creek substation near Brush, Colo. Contractor will furnish required steel structures and the Government will furnish the electrical equipment.
Columbia Basin, Wash	Construction of 10 miles of drains in lateral area W-3 (block 71) will consist of excavating unlined ditch varying from 15 to 5 cubic feet per second capacities with base width of 3 to 2 feet, and constructing concrete structures, including drain inlets and road crossings. Located about 4 to 10 miles southwest of Ephrata, Wash.
Do	Construction of 12 miles of 555 to 425 cubic feet per second capacity Potholes East Canal of 20-foot bottom width and 45 miles of 72 to 2 cubic feet per second capacity laterals and wasteways of 10- to 2-foot bottom width; and 2.4 miles of 12- to 48-inch diameter pipeline for the remainder of lateral area P-9. Work located about 18 miles north of Pasco, Wash., near Eltopia.
Do	Moving 7 2-bedroom temporary houses from present Government camps to new locations on the W39.9 lateral in area W-6A, the Frenchman Hills wasteway area W-7, Scooteney headworks area P-2, the Babcock pumping plant area W-8, and EL-45 and Lind Coulee wasteway in area E-4, and converting them into houses with basements. Contract includes construction of garages, pump houses, and streets at the new sites and installation of utilities.
Do	Sealing about 4 miles of unlined canal prism on the fourth section of West Canal, about 9 miles south of Quincy, Wash., consists of excavating, replacing with select compacted material, and covering with a gravel blanket.
Do	Construction of a timber county road bridge of standard design, timber superstructure with concrete piers and abutments, across West Cana fourth section extension near Frenchman Hills tunnel. Work also includes barbed-wire fencing, chain-link fencing, cattle guards, and safety screens at several locations along the East Low and West Canals and at the Frenchman Hills tunnel.
Do	Construction of area P-4 (block 13) laterals, sublaterals, and wasteways varying from 288 to 3 cubic feet per second capacities. Work consists of excavating 45.3 miles of unlined laterals and wasteways with base widths of 2 to 16 feet, 14.5 miles of pipeline from 12- to 60-inch culvert and pressure pipe, concrete structures including division boxes, weirs, culverts, drops, 7 small pumping plants, and 3 bridges.
Do	Placing floor finishes in a 4,200-square-yard area of Grand Coulee pumping plant at Coulee Dam, Wash., and installing 6,000 feet of base and 1,000 feet of curb.
Davis Dam, Ariz.-Nev.	Addition of 1 115-kilovolt bay to high-voltage bus structure including high-voltage switching equipment installation, and installation of an additional 8,000/10,000-kilovolt-ampere OA/FA unit substation, and addition to 12.5-kilovolt bus structure at ED-2 and ED-4 substations between Casa Grande and Eloy, Ariz. Steel structures and electrical equipment will be Government-furnished and the contractor will remove the unit substation for ED-4 from Maricopa substation.
Davis Dam, Ariz.	Installing static-capacitor, wood-pole structures and chain link fence near Boundary pumping plant 5 miles south of Gadsden, Ariz.
Do	50,000 pounds of fabricated, galvanized structural steel for bolted switchyard structures, ED-2 and ED-4 substation additions.
Do	35,000 pounds of fabricated, galvanized structural steel for bolted switchyard structures, Coolidge substation additions.
Do	50,000 pounds of fabricated, galvanized structural steel for bolted switchyard structures, Oracle substation.
Gila, Ariz	Construction of unit 2 of Wellton distribution system, which will irrigate about 7,700 acres surrounding Wellton, Ariz., consists of 26 miles of unreinforced concrete-lined laterals, 9 miles of wasteway channels, 3 jacked-pipe railroad siphons, and checks, drops, pipe road siphons, turnouts, bridges, deliveries, and wash siphons. Contract includes furnishing and laying 1 mile of 30- to 54-inch diameter concrete pipe, about 360,000 cubic yards of lateral and structure excavation, and 400,000 cubic yards of channel and dike excavation.
Do	Construction of about 22 miles of unreinforced concrete-lined laterals and sublaterals of 45 to 15 cubic feet per second capacities for unit 4 of Mohawk distribution system near Wellton, Ariz.
Hungry Horse, Mont	Treating roofs of 75 camp buildings and painting interiors of administration building and conference hall near Columbia Falls, Mont.
Do	Modification of dormitory, insulating interior of Imhoff tank building, and electrical installation in 6 multiple-stall garages near Columbia Falls, Mont.
Do	Constructing concrete walks and steps for 46 prefabricated residences near Columbia Falls, Mont.
Kendrick, Wyo	Furnishing and placing about 4,500 feet of earth or buried asphaltic membrane lining on Casper Canal in Natrona County about 28 miles southwest of Casper, Wyo.
Do	Furnishing and placing about 13,000 feet of buried asphaltic membrane lining for laterals 256 and 218, and furnishing all materials except bentonite, and placing about 3,600 feet of buried bentonite membrane lining for laterals 156 and 256-27, in Natrona County, about 7 miles west of Casper, Wyo.
Middle Rio Grande, N. Mex.	Channel rectification work on the Rio Grande in the area of San Antonio, Escondido, and San Acacia, N. Mex.
Missouri River Basin, Kans.	Completion of Webster Dam on the south fork of the Solomon River about 1 mile downstream from Webster, Rooks County, Kans., includes the following work: Completion of earth-fill dam 110 feet high and about 11,000 feet long at 30-foot wide crest. Upstream slope will have riprap protection. (Foundations of portions of dam are under construction.) Construction of earth-fill dike on left abutment, 20 feet high and about 2,000 feet long at 30-foot wide crest. Construction of concrete outlet works consisting of an intake structure, a 220-foot long, 4.5-foot diameter conduit, a gate chamber, a 270-foot long, 8-foot horseshoe conduit with steel pipe, a control structure, stilling basin, and a riprap-protected outlet channel. Construction of concrete spillway consisting of a crest structure 116 feet wide controlled by 3 radial gates 33.33 feet by 39.08 feet, a 658-foot long chute, stilling basin 264 feet wide by 130 feet long, and a riprap-protected outlet channel.
Do	Construction of 7 miles of unlined laterals and drains of 18 to 6 cubic feet per second capacities and unreinforced concrete structures for Courtland Canal's second section near Mankato, Kans. Involves about 69,000 cubic yards of excavation.
Missouri River Basin, N. Dak.	150,000 pounds of fabricated, galvanized structural steel for 115-kilovolt single-circuit towers, Garrison-Volaire transmission line approach to Garrison switchyard.
Tucumcari, N. Mex	Construction of about 4 miles of scattered drains and rehabilitation of one existing drain and related structures near Tucumcari, N. Mex. Work also includes a small amount of canal and lateral lining.
Vermejo, N. Mex	Rehabilitation of Vermejo diversion dam, 11 miles of 600 cubic feet per second Vermejo Canal, and 24 miles of 300 cubic feet per second Eagle Tail Canal, 8 miles northwest of Maxwell, N. Mex., includes: Revising diversion dam headworks structure by lowering gate sills, blocking the 9 existing openings, enlarging the outlet structure to 450 cubic feet per second capacity, and installing 9 new slide gates Existing sluice gates will be replaced by 3 new slide gates with some earth dike and bank riprap protection. Canal and channel excavation, new sluiceway, siphons, wasteway drops and drainage inlet structures for the Vermejo Canal. Canal excavation, 1,400 feet of Kellner-type jetties, 1,800 cubic yards of dumped riprap on river bank, gate-controlled sluiceways, checks, siphons, and drop structures for Eagle Tail Canal.
Yakima, Wash	The 6 6 miles of 500 cubic feet per second capacity Chandler Main Canal, Division 1, and 0.6 mile of 435 cubic feet per second Kiowa wasteway to be constructed near Prosser, Wash., will be concrete-lined for 1 mile and unlined for the remainder.
Do	2 railroad undercrossings to be constructed on the Chandler power canal will be monolithic reinforced concrete siphons, 1 415 feet long and the other 320 feet long, under railroads 4 and 6 miles east of Prosser, Wash. Each siphon is to have 2 11.5-foot inside diameter barrels and inlet and outlet transitions.

United States Department of the Interior, Douglas McKay, Secretary

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Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

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REGION 7: Avery A. Batson, Regional Director, Building 46, Denver Federal Center, Denver, Colo.
California Projects Organization, Clyde H. Spencer, Supervising Engineer Box, 2511, Fulton and Marconi Avenues, Sacramento 11, Calif.

*See note on page 137 regarding California Projects Organization.

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The Reclamation Era

October 1953

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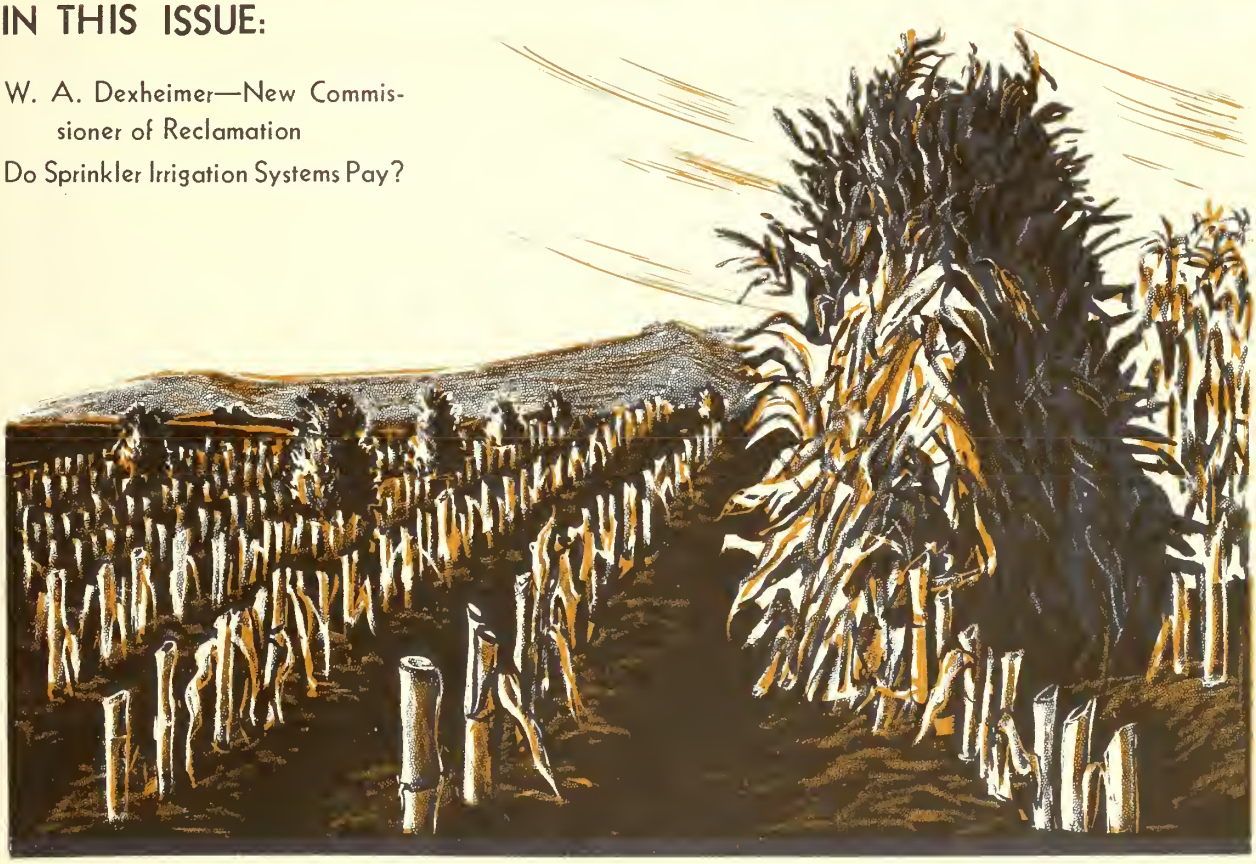

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IN THIS ISSUE . . .

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Bureau of Reclamation, Washington, D. C.

J. J. McCARTHY, Acting Editor

Issued quarterly by the Bureau of Reclamation, United States Department of the Interior, Washington 25, D. C. The printing of this publication was approved by the Director of the Bureau of the Budget, May 5, 1953.

Special Notice to All Subscribers

The July 1953 issue of the Reclamation Era was the first under our new quarterly publication schedule. This is just a reminder in case you missed the special notice in the July issue.

Subscription rates for the quarterly publication are 50 cents per year, with 15 cents additional required for foreign mailing. Separate copies may be purchased for 15 cents each. Under the new policy all subscriptions should be sent direct to the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Requests for changes in mailing address should also be sent direct to him.

Subscriptions now in force will be extended for a maximum period of 2 years from last July. If, at the expiration of that time, subscribers have not received all copies due them under the previous subscription rate, a refund will be made by the Superintendent of Documents.

WATER FORECAST

THE NEXT QUARTERLY ISSUE of the Era, due in January, will appear in February, and each subsequent quarterly issue will be advanced by one month, i. e., May, August, and November. This change in schedule is necessary in order to continue our spring and fall features, namely, WEST-WIDE WATER FORECAST (May issue) and WATER REPORT SUMMARY (November 1954 issue).

The Summary will not be published this fall. However, the foregoing change in issues will permit us to get back on schedule and bring you both the Forecast and Summary.

WILBUR A. DEXHEIMER of Denver, Colo., popularly known as "Dex," and a Bureau engineer for 25 years, is the new Commissioner of Reclamation. After his promotion by appointment of President Eisenhower on July 13, he took the oath of office in the office of Interior Secretary Douglas McKay who had recommended him to succeed Michael W. Straus, who resigned in February. Under Secretary of the Interior Ralph A. Tudor with whom he had worked in China introduced the new Bureau Chief.

On July 14, the new Commissioner was individually welcomed by all of the employees of the Washington office of the Bureau. On July 15, he joined Secretary McKay in Denver where the latter inspected Reclamation offices and facilities, and addressed employees on July 16.

A career employee, Commissioner Dexheimer has been with the Bureau of Reclamation since 1928, with the exception of 4 years he served as an officer with the Corps of Engineers during World War II, and a year with an American engineering firm in China as a consultant.

W. A. DEXHEIMER

The New Commissioner of Reclamation

Born in Denver, Colo., in 1901, he attended the University of Denver, and later the Colorado A and M College where he received his Bachelor of Science Degree in Civil and Irrigation Engineering in 1926. Concurrent with college attendance he worked for the Denver and Rio Grande Railway, and on graduation served as assistant city engineer for Fort Collins, Colo., and as location engineer for the Union Oil Co., before joining the Bureau of Reclamation in 1928. On his first Reclamation job he was chief of survey party, locating canals, tunnels, and structures on the Kittitas Division of the Yakima Project at Ellensburg, Wash. In 1929 he worked on the location and topographical survey of the Boulder Dam Project. From 1931 to 1936 he was an engineer on construction of Hoover Dam and Power Plant. He also served as Field Engineer on the Bartlett Dam, Salt River Project in Arizona. Following this, he was assigned to Shasta Dam on the Central Valley Project until 1942, when he became a captain in the Corps of Engineers. He served until 1946, when he was honorably discharged as a lieutenant colonel. His principal service was in China, including a detail as assistant theater engineer in the China-Burma-India theater. He was decorated with the Bronze Star, and is one of four Americans to receive the Chinese Order of White Cloud.

After leaving the military service, he became consulting engineer for the Morrison-Knudsen International Co., and participated as assistant chief engineer in planning rehabilitation of railroads, highways, and ports in China.

In 1947 he returned to the Bureau of Reclamation at Denver and served as Assistant Chief Construction Engineer until his appointment as Commissioner. During this period (1947–53) he was detailed to the State Department as a consulting engineer for investigation and planning of

Please turn to page 174

OPENING NEW FRONTIERS

By L. R. SWARNER, Irrigation Engineer, Region 1, Headquarters, Boise, Idaho

LAND OF HOPE—thanks to irrigation. *Stan Rasmussen photo.*

"The names of 72 lucky war veterans were drawn today for farm units on the North Side Pumping Division of the Minidoka Project. These farm units, which average 100 acres of fertile irrigable land, are the first block of an ultimate 700 homestead units to be furnished water by the Bureau of Reclamation through pumping, largely from underground water." Thus read a part of a news item in a local paper on August 4, 1953. Truly those receiving farm units were lucky, for a total of 4,431 names were in the hopper at the time of the drawing. Lucky? Yes, but not in the sense that they are receiving a gift on a silver platter, but because of the opportunity afforded them to develop and own an irrigated farm through hard work and sacrifices. But let's get the story behind the story and see why those receiving farm units are really lucky. Let's look at the planning and work which preceded and made possible the successful drawing.

Lands of this Division as authorized by Congress, are in 2 units comprising approximately 77,650 acres of irrigable land in the Snake River Plain and are perhaps the most fertile remaining undeveloped in Region 1. Detailed investigations were necessary for the two essential components of a successful irrigation project—good land and a good water supply. This irrigable area was selected from a large body of land withdrawn for reclamation as being well suited for irrigation as the result of a detailed land classification. The feasibility of pumping water from 150 to 200 feet demanded that the standards for land classification be held high and that only the best lands be provided with a water supply. The selection of the project area was the result of an integrated analysis of lands based on both physical and economic factors.

Unit A, comprising approximately 13,650 acres of irrigable land, will receive its water through

a pumping plant located on the Snake River in the backwaters of Milner Dam. The water will be pumped into an open lateral system approximately 158 feet above the elevation of the water in the river. The completion of the Palisades Reservoir, now under construction, located near the headwaters of the Snake River with an active storage capacity of 1,200,000 acre-feet, will insure an adequate water supply for this unit.

The water supply for the 64,000 irrigable acres in Unit B will be provided from approximately 131 wells tapping the "Lost River" which presumably flows underground 150 to 200 feet below the surface of Snake River Plain. (Reclamation Era—April 1951—"Tapping Lost River"). Many questions had to be answered as to the amount, depth, and availability of the underground supply. To answer these problems, the Bureau of Reclamation began drilling and testing wells in this area in 1948. Already privately owned land adjacent to, and within, the Division boundaries have been developed at a rapid rate until approximately 23,000 acres were irrigated from ground water by private owners in 1951.

In the initial development, the lack of adequate information on the water supply demanded that the supply be tested before the land was opened to public entry. To accomplish this, the raw lands in sagebrush were leased on a competitive basis to private individuals. These individuals were required to clear, level, and farm the land, thus utilizing the water pumped from the wells. Approximately 5,000 acres of the 7,200 in the 72 farm units are presently under full production. The leases for this land expire at the end of this crop season, and the entrymen will take over. The veterans receiving these units will be especially lucky.

From the information secured from the 10 irrigation wells and several observation wells and from the records of the United States Geological Survey as to the ground-water table in the area, it now appears that there is no necessity for testing the irrigation wells for several years before opening the land to public entry. The project water supply will, of course, be under continual observation during the development period.

The policy of establishing family-sized farm units whereon an entryman can maintain an adequate standard of living for his family and meet the construction and operation and maintenance charges is especially important on this project, since the operation and maintenance charges due to the high pumping lift will be considerable. A careful study of the size of farm unit has been made to insure the entryman of a successful future if he follows good agronomic practices. The size has been determined after a careful study of the agricultural economy of the area and this varies proportionately with the classes of land found in each unit. The present size has been concurred in by the Extension Service and Agricultural Experiment Station of the University of Idaho, and the

STEP NO. 1—Remove heavy brush covering fertile land. ***Phil Merritt photo.***

WELLS TESTED with diesel motor (top photo). Pumps with electric motors pump 4,500 gallons per minute from depth of 230 feet (above). *Top Photo by Phil Merritt, above photo by Ston Rosmussen, both of Region 1.*

Farmers Home Administration of the Department of Agriculture.

The actual layout, survey and acreage determination of the farm units to meet these requirements is the biggest job in getting the units ready for entry. Preliminary boundaries are laid out on topographic sheets on which the land classification has been transposed. When advantages can be gained from the standpoint of farm organization or operation and irrigation deliveries, departure is made from the rectangular survey or regular subdivision. This requires careful study of the general irrigation plan for each unit and often creates problems regarding the location of roads which normally are found on section lines. The relocation of roads requires close cooperation with the local road districts, since it is necessary to obtain their approval of any road plan which deviates from the normal procedure. Where no particular advantage is to be gained from following topographic boundaries, regular legal subdivisions are used for boundaries. After the farm units have been laid out on paper, concurrently with the wells and necessary laterals, a careful check is made of the farm unit boundaries in the field. This generally results in greater refinement and insures proper location of the laterals and farm unit boundaries.

The use of topographic features for unit boundaries requires that a supplemental survey of the tracts be made and be described by a metes and bounds description. This requires considerable more work than if legal subdivisions were used, but the benefits derived through better farm organization and operation over a period of years far exceed the cost of the supplemental surveys. Thus, considerable difference results in the shape of the farm units on the newer farm unit plats as compared to the old farm unit plats as show in accompanying illustrations.

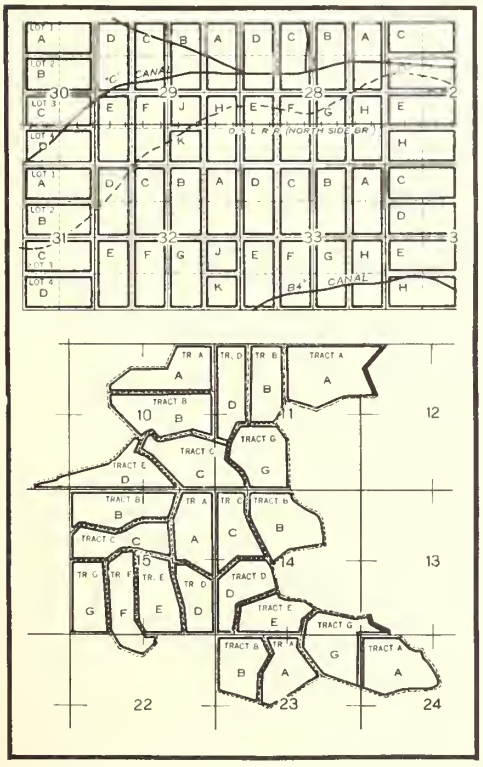
Among the most convincing facts to bear out the fact that the entrymen are lucky are the records of production obtained from these lands during the period they have been leased. Per-acre yields as high as 55 bushels of barley, 45 bushels of dried peas, 21 tons of sugar beets, 15 sacks of beans, 300 sacks of potatoes, 70 bushels of wheat have been obtained on this new land. Accurate records of development cost, water use, fertilization, and soil management have been obtained during this period of leasing in order to substantiate the data used in setting up the size of farm unit and the water requirement.

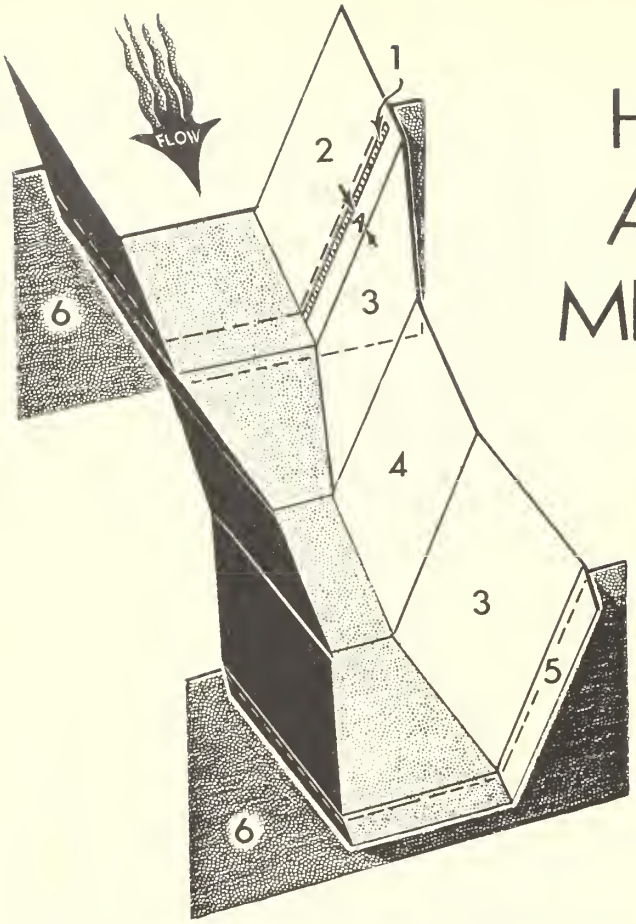
Thus we see that, unaccompanied by publicity and fanfare, a tremendous amount of work and effort has preceded the public drawing. This work and planning is the insurance policy that protects the entryman who receives the farm unit. He is indeed lucky, as it has been demonstrated that, with the proper agronomic practices, he will be able to make a success on the lands of the North Side Pumping Division, thus bringing to pass the vision of agricultural development many local residents have had for more than 40 years.

# # #

COLD, CRYSTAL CLEAR, pure water for irrigating this land comes from deep down in the earth below the desert (at left). Immediately below, Irrigating dry beans by sprinkler system on North Side Pumping Division, Minidoka project. Next, Arnold M. Critchfield checks flow of irrigation water into a small lateral on his potato field. Bottom photo, EVIDENCE OF PRODUCTION BY IRRIGATION. *First three photos by Phil Merritt, bottom photo by* Stan Rasmussen, *both of Region 1.*

1st Map shows farm unit based on rectangular surveys. Map at bottom of page—farm units based on topographic and land capability survey.





HOW TO BUILD AN INEXPENSIVE MEASURING FLUME

Based on information contained in a paper by ADRIAN R. CHAMBERLAIN, Graduate Research Assistant, Agricultural Engineering Department, Washington State College

Year by year experts are learning more and more about the amounts of water needed for maximum production of various crops. If you're a farmer who wants to keep pace with the experts and capitalize on this new knowledge, the logical step is to find a way to accurately measure the amount of water you provide your crops.

A simple water-measuring device, developed by Washington State College and named "The WSC Flume," may be what you're looking for. Not only does it offer an easy and accurate way to measure water, but it's also easy to build and install, and inexpensive.

The Extension Service of the College has devised a standard pattern which can be varied in size to make the flume with a capacity of 15 to 100 gallons per minute; or 50 to 1,200 gallons per minute.

All the flume's seven sections can be made from four simple templates. They are assembled together and easily transported to the field and installed. A scale, graduated in eighths of an inch, provides a means of measuring the water.

Sheet metal is recommended in making the flumes, since it makes the finished product easy to install and easily portable. The flume requires little material. The 15 to 100 gallons per minute flume requires a 3- by 2-foot sheet of 20-gauge metal for the flume, a 2- by 1½-foot sheet of 16-gauge for the cut-off walls, and a 7½-inch plastic or steel scale. The larger, 50 to 1,200 gallons per minute flume involves a 4-foot by 7-foot sheet of 16-gauge metal or heavier for both flume and cut-off walls. Its rule should be 15 inches long, graduated in eighths.

Lumber can be used in the construction, provided it is finished on one side and both edges, and all edges or corners which protrude into the channel are rasped or planed off. Inside dimensions of wood or concrete construction should match the dimensions on the diagrams. Concrete construction makes a permanent installation. If concrete is used, however, the inside surfaces should be a smooth mortar plaster finish.

Once the parts are cut from the metal, they may be put together by soldering, if you're making the smaller flume, or by arc welding if it is the larger flume. The flume can be fabricated in a number of ways, but it's suggested that a tinsmith or sheet-

At right, layout plans for flume with capacity range of 15 to 100 gpm. Note: Dashed lines indicate bends 60° from horizontal. See next page for larger capacity flume layout plans.

metal worker do the work or be consulted. Care should be taken to make sure the inside of the joints is smooth.

The only requirement for correct field installation is that the bottom of the flume must be level, both across and along the flume. The floor of the flume should be level with or—preferably—slightly above the bottom of the ditch.

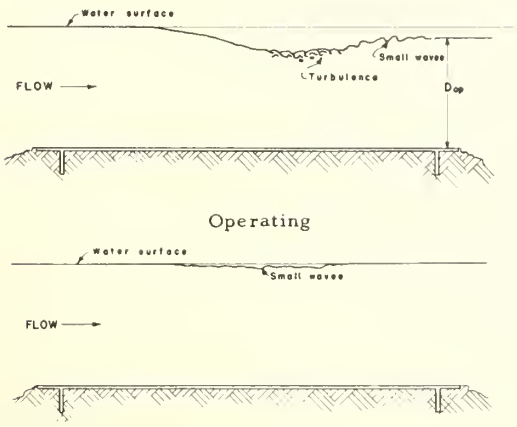
One precaution must be observed if the flume is to give accurate results. It is not operating when "drowned out." If the water surface is a common level upstream, through and below the flume, it is drowned out. If the flume is not working, or if there is any doubt that it is, you should either (1) raise the entire flume a bit; or (2) clean the ditch for a short distance downstream so that the water is not dammed up as much below the flume.

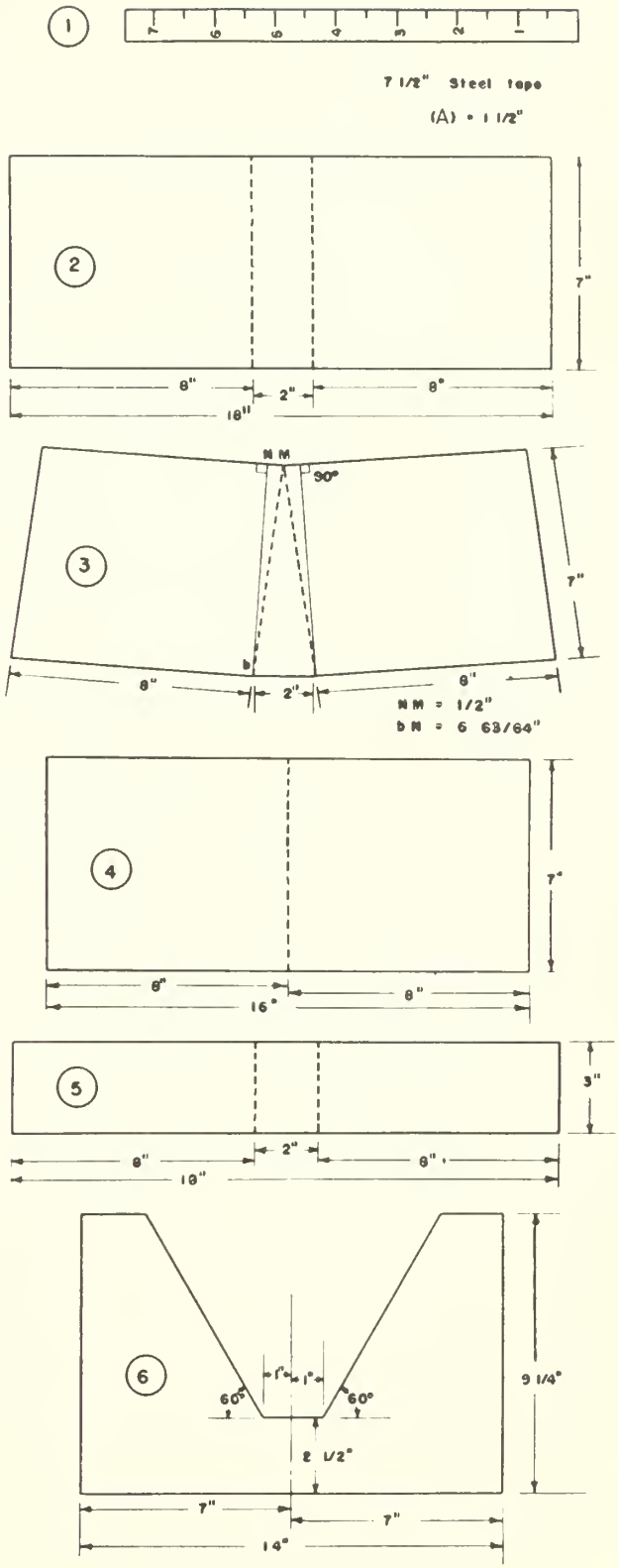
The WSC flume can be used in nearly any ditch that has a slope of less than a half-foot per 100 feet, which gives it a distinct advantage over most other measuring devices which can't be used on a flat slope of one-half percent or less.

Once the flume is properly constructed and the water flow is under way, simply read the scale in inches and calculate the volume of flow on the curve.

Properly constructed, the WSC flume is not only accurate and easy to install and operate, but it offers a larger range of capacities and smaller head loss than weirs and other similar devices.

# # #





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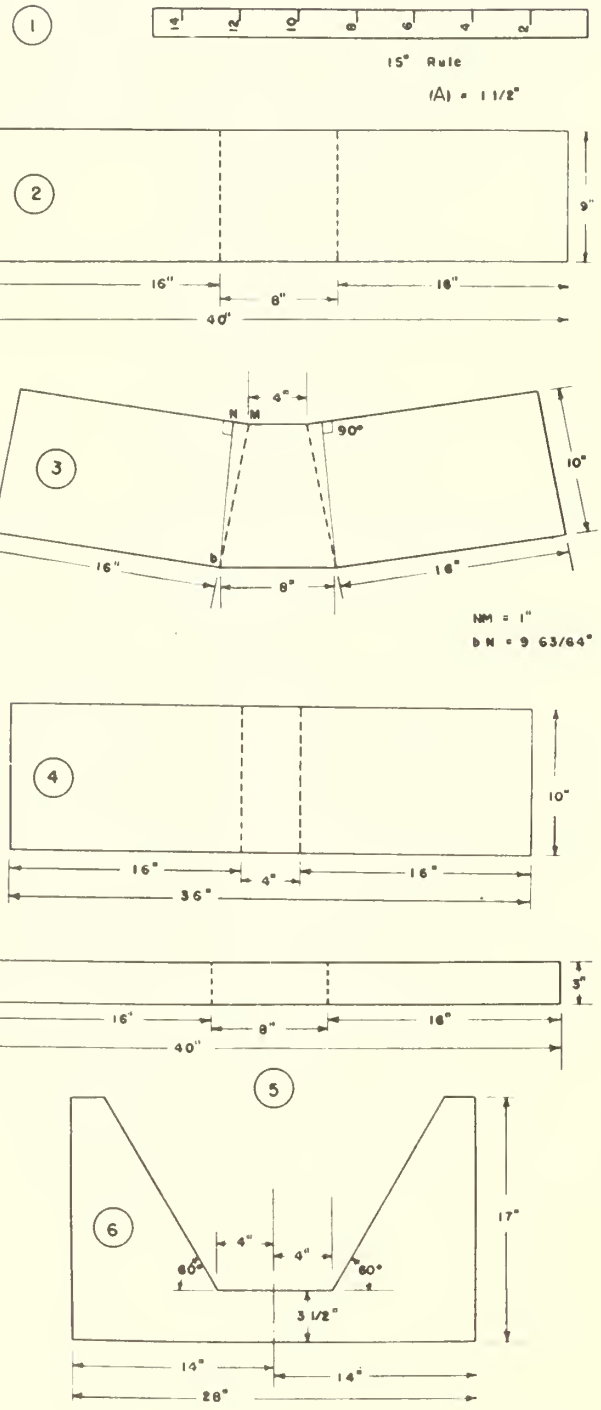
Layout plans for flume with capacity range of 50 to 1,200 gpm.
Note: Dashed lines indicate bends 60° from horizontal.



SECOND ANNUAL "WEED HOLIDAY"

Three hundred and fifty members of the families of farmers and businessmen on the North Unit of the Deschutes Project in central Oregon on last June 9 combed an estimated 200 miles of irrigation canals and roadside and rogued out hundreds of noxious weeds offering a threat of pollution to the dominant small seeds crop.

The mass activity of weed destroyers constituted the second annual Jefferson County "Weed Holiday" (see Deschutes "Weed Holiday," p. 210, September 1952, Reclamation Era), an activity launched by a number of groups in the 50,000-acre irrigation district to make the entire population conscious of the economic threat of noxious weeds.

So far as is known, it is the only such holiday of its kind in the nation. Dr. A. H. Stewart of the Oregon State College herbarium, who was present at the affair, declared in an address to the group that he knew of no other place in the world where such an intense interest in weeds is taken as on the Deschutes Project.

An award was offered for stumping Dr. Stewart and Dr. Gilkey, which was won by Bruce Nicholes.

Participating in sponsoring the "Weed Holiday" were members of the North Unit Irrigation District, Jefferson Seed Growers Association, Jefferson County extension service, Madras-Jefferson County Chamber of Commerce, Jefferson County Cooperative Association, the U. S. Bureau of Reclamation, and various private business concerns serving the small seeds industry.

A delegation from nearby Yamhill County was present to observe how the holiday works. Members said they propose to launch a similar program there to protect the small seed crops from an invasion of noxious weeds. Dr. Helen Gilkey also of the Oregon State College herbarium expressed the hope that the campaign started on the new project would spread to the rest of the state. #

Do Sprinkler Irrigation Systems Pay?

By ROLAND C. BEVAN, Associated Agricultural Economist, University of Idaho Agricultural Experiment Station

Above: General view of the L. H. Peters farm, in the Willamette Valley, Oreg., under sprinkler irrigation. *Photo by Stan Rasmussen, Region 1.*

Farmers considering an investment in a new machine or a new building try first to answer the question, "Will it pay to do this?" This question arises for example when considering the purchase of a beet harvester or a hay chopper or the purchase of a sprinkler system.

How can this question be answered? By comparing the estimated annual costs of the item with the estimated added income resulting from its use. The costs will include those arising in the year of use and the initial cost spread over the estimated life of the item (we call this depreciation). Interest on the investment must also be included even if no money is borrowed to make the purchase. The returns should be figured at the prices expected over the life of the item. One must use expected future prices, rather than present or past prices. This is because the investment must be paid for out of future income. Naturally, if future prices are expected to be high, it will be easier to pay for the purchase. On the contrary, if they are low, it will be much more difficult to do so.

What are the costs and returns from the use of a sprinkler system? Some information is available on sprinkler costs but practically nothing on the return side. The returns would be the added incomes due to increased yields or to the production on land which could not previously be irrigated. This added production would be valued at expected future prices.

Some guides to the costs of sprinkler systems are found in the material obtained by the Idaho Agricultural Experiment Station from 61 farmers in 1948 and 1949.[1]

[1] Summarized in Idaho Experiment Station Bulletin 287, *Costs of Sprinkler Irrigation on Idaho Farms*, Max C. Jensen and Roland C. Bevan.

In this study the annual costs of sprinkler systems were found to be $18.95 per acre for systems obtaining water from free sources, and $18.20 per acre for systems buying water from an irrigation company. Few farmers had average costs. Most of them had higher or lower costs than those cited. The size of the area sprinkled was probably the most important influence on cost. Systems sprinkling 25 acres or less showed an average annual cost of $26.83 per acre. Those sprinkling 50 acres or more on the other hand had annual costs averaging $16.09. Little difference was found between the annual costs of systems obtaining water from free sources (as a well, pond, stream or lake) and those buying water from an irrigation company. This is because the systems obtaining water from free sources were forced to invest in more expensive installations to lift or transport their water to field level. The individual items of cost for the two types of installations are shown below:

Average Annual Costs Per Acre for Sprinkler Irrigation, Idaho, 1948–49

Item of cost	Free-water source	Purchased-water source
Depreciation	$6.90	$4.40
Interest on investment	2.60	1.65
Water	0	3.55
Repairs and maintenance	.40	.25
Power	3.75	3.10
Labor	5.30	5.25
Total annual cost	18.95	18.20

Depreciation is the initial cost spread over the estimated years of life of the systems. On the average, farmers estimated these systems would last 15 years but the range of estimates was from 10 to 40 years. If the system lasts 30 years the annual depreciation is only one-half that on one lasting 15 years. This estimate of life was difficult to make because none of the systems had worn out yet. Lower per acre depreciation costs were found for the larger systems, the less elaborate systems, and for those used on regularly shaped tracts of land. Note that the depreciation cost is 50 percent greater for the systems using water from a free source.

Interest on the investment is calculated at the going rate of interest on one-half the initial cost. Since the system decreases in value over its life from the initial cost to nothing, the average value is halfway between or one-half the initial cost. The average interest rate paid was 5 percent, so this rate was applied to one-half the initial cost to obtain the interest charge. This will vary for much the same reasons the depreciation varies. Lower interest charges will result from using the system on a larger acreage and from less elaborate and less expensive installations.

Water when purchased will be included at the cost per acre of obtaining it from the irrigation company. Those systems using water from a free source will of course not have this cost.

Repairs and maintenance are a small item for a sprinkler system. Couplers and sprinkler heads may need replacement and some repairs may be necessary for pumps and motors. This cost was especially low for these systems because they were new and few repairs were needed as yet. Higher costs would be expected as the systems become older, but these will still be only a small part of the total annual cost.

The power cost is merely the amount paid for electricity used to pump water through the systems. The cost per kilowatt hour averaged 9 mills, but was lowest for the systems using more kilowatt hours per month. The power cost varied of course with the number of irrigations and amount of water applied. It also varied with the lift to field level and the pressure per square inch in the system. A few farms used gas engines for power instead of electricity. On these farms the annual costs of operating these gas engines would be substituted for the charge for electricity.

The labor moving the sprinkler pipes averaged nine-tenths of one man hours per acre per irrigation. This is almost exactly the same charge obtained in previous studies in Idaho for labor irrigating by surface methods. This charge for labor varied with the number of irrigations. The value of the labor was figured at 75 cents per hour to obtain the cost shown.

As can be seen, costs vary widely between farms. Published data, such as that cited above is a guide to farmers who seek to estimate what their own costs would be. They should, however, use the costs for their own situation. Figures such as those shown are merely a guide in making such an estimate. By comparing the annual costs per acre with the expected increase in income per acre the farmer can answer the question—Will sprinklers pay? # # #

INGENUITY saved the crops

By WILLIAM A. PRICE, Agriculturalist, Region 7, Bureau of Reclamation, Denver, Colo.

BIG THOMPSON PROJECT water by-passing Pole Hill Power Plant en route to Little Hell Creek. *Photo by Roy Anderson, Greeley Doily Tribune Stoff.*

Drought didn't ruin the late maturing crops on approximately 75,000 acres of fine northeastern Colorado farmland this past summer, thanks to what farmers in the area have dubbed the "back door" method of irrigation water delivery.

The novel method of getting water from the still incomplete Colorado-Big Thompson Project onto the drought-threatened farmlands involved working out a unique bypass around the unfinished project works, utilizing a creek, a river, two irrigation canals, four diesel pumps, and some good old-fashioned team work.

It all began back in March 1953, when the secretary-manager of the Northern Colorado Water Conservatory District announced that 100,000 acre-feet of Colorado-Big Thompson water was available for supplemental irrigation. The announcement evoked mixed emotions in northern Colorado farmers. Those owning farms under the Cache la Poudre and Big Thompson Rivers could and did place their orders for the water, rounding out their needs for the season. But others, whose lands lay just to the south and are served by ditches originating from the Little Thompson and St. Vrain Rivers, received the announcement with bitter disappointment.

They reacted thus because the St. Vrain Canal, which will carry Colorado-Big Thompson Project water to them, is not scheduled for completion until the spring of 1954. Meantime, it appeared there was no feasible way to get the water during the 1953 growing season for late irrigation of sugar beets and corn.

That's where the "back door" delivery system came in. Water from the Big Thompson Project was diverted at a point high in the foothills of the Colorado Rockies. The water was turned, instead of into the penstocks of unfinished Pole Hill powerplant, over the boulder-strewn side of the mountain into a gulch draining into Little Hell Creek.

In turn, Little Hell Creek conducted the man-made torrent into the Little Thompson River. Thence it was diverted by the Ish Ditch Company into the Ish ditch and conducted out into the farming area on the plains east of the foothills.

But still other farmers to the south didn't have a source of supply. So a sump was dug and four diesel pumps installed at a point where Ish Canal is near to the Highland Canal. From the Ish upward almost 30 feet to the Highland went the precious water, by pump, and from the Highland to the farmers who had not pictured earlier in the season how they could possibly acquire any Colorado-Big Thompson Project water in 1953.

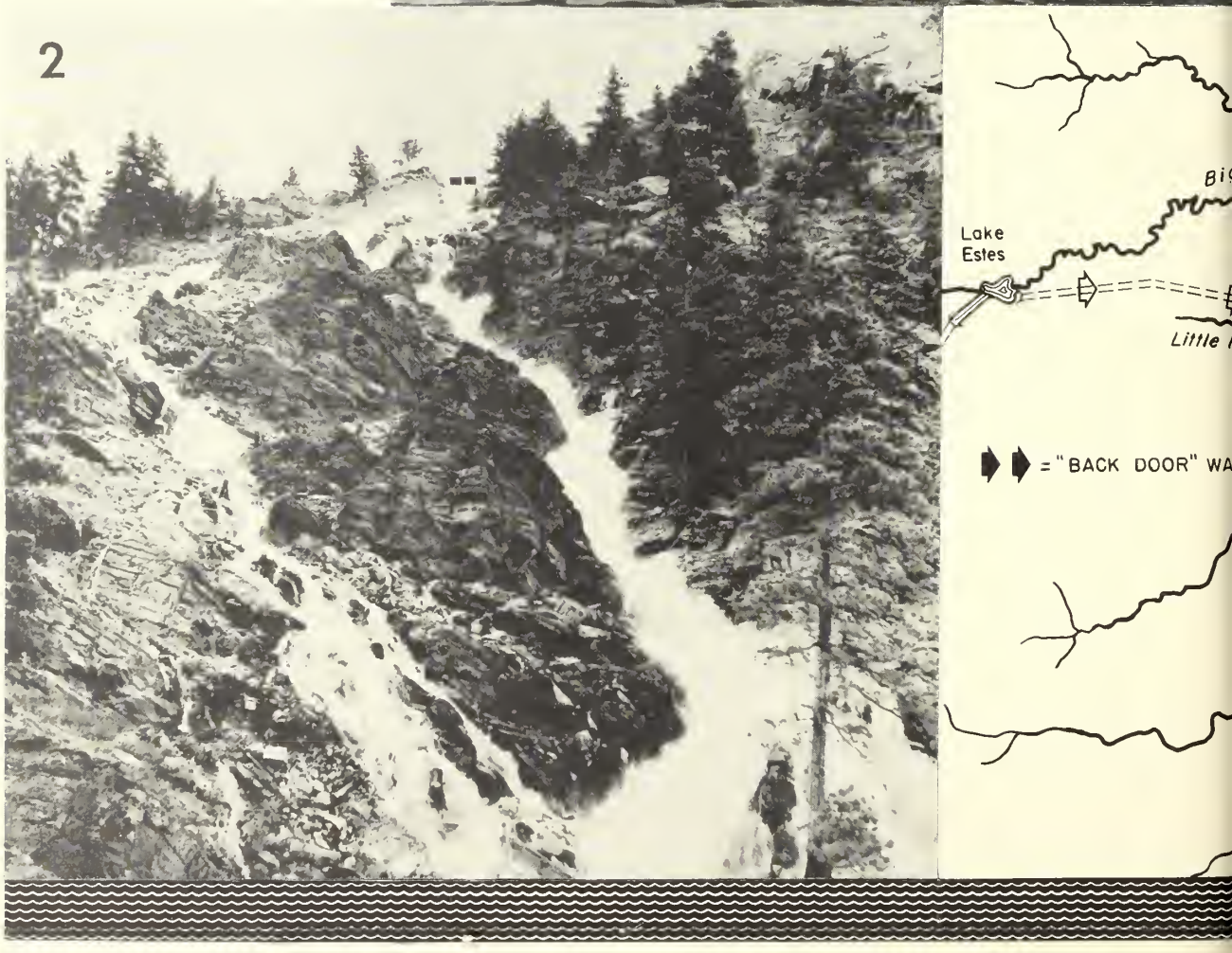
Altogether, this arrangement and water exchange made possible the delivery of 18,580 acre-feet of additional water to farmers under the Ish and Highland Canals. Late maturing cash crops were saved from drought.

What this meant to the farmers was summed up by one of them, John K. Schell, who lives near Mead, Colo. He said:

On July 5, I was informed that I had 167 inches of water left to my credit. That was just enough to irri-

Please turn to page 165

(1) Water standing in Pole Hill Canal. Gate in structure shown was lowered so water would rise high enough to overflow into bypass. (2) Water headed for Little Thompson River flowing from the overflow structure in gate house above Pole Hill Penstocks and down steep bypass to Little Hell Creek and Little Thompson River. Diversion provided supplemental irrigation to Little Thompson River and Highland Ditch. (3) at top, Colorado Big Thompson water which bypassed Pole Hill Plant enters pump sump from Ish Ditch. Four diesel engines and 10" suction pumps are beneath pipes. Note Highland Ditch wasteway, upper left. (3) below, pumped water from Ish Ditch entering the Highland Ditch. *Photos (1) and (2) by Ray Anderson, (3) photos by Paul Emery, both of Greeley Daily Tribune Staff.*

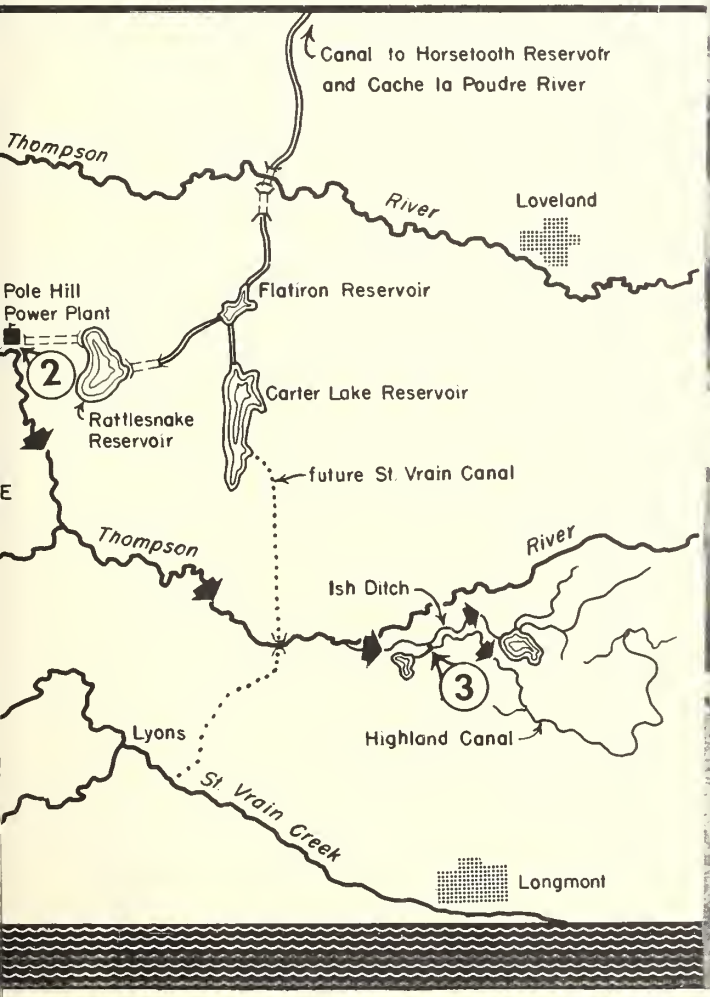


INGENUITY

(Continued from page 163)

gate my corn. So for all practical purposes, my ditch was to be dry after July 8. I had 30 acres of sugar beets and 17 acres of corn which had made a wonderful start and I hated to see them burn. But then I was informed that I could get plenty of water (thanks to the back door method) to irigate my sugar beets and corn at least twice after my Highland Ditch water was done. Without Colorado-Big Thompson water coming in through the back door, my crops would have really suffered. Thanks to the Conservancy District, my ditch company board, and the Bureau of Reclamation, I will again pay an income tax for 1953. I am especially thankful to Mr. Charles Meador, who has been superintendent of our Highland Ditch for 45 years and has given a lifetime of service to Highland Ditch water-users.

If for any reason we cannot get supplemental irrigation water directly down the St. Vrain next season, my back door is still open, so—bring it in the back door!



THE MEINERS, Kathy, 4, and Terry, 6. *Photo by Stan Rosmussen, Region 1.*

National Employ the Physically Handicapped Week has been designated as October 4–10 by President Dwight D. Eisenhower. This is the ninth year in which the "Week," which only points up the problem, will be observed. The program for employing the physically handicapped includes every week in the year. There can never be any relaxations in the continuing programs that are carried out in the national, state and community levels in the interest of those with THE WILL TO WIN.

In a message to members of the President's Committee on Employment of the Physically Handicapped, the President said recently: "* * * I share with thousands of other Americans a deep interest in the future of handicapped people in this country. * * * Our Nation can ill afford to lose the productive power and talents of those who are idle because they are disabled. We need them as active, productive citizens."

Last year the *Reclamation Era*, at the request of Vice Admiral Ross T. McIntyre (MC), USN, Retired, Chairman of the President's Committee on Employment of the Physically Handicapped, cooperated by publishing the article, "Ready, Willing, and Able" in the October 1952 issue. Here is this year's story of people in the Reclamation area who have already proven the wisdom of Admiral McIntyre's statement when he said: "It must be recognized that rehabilitation must be made available to more and more people and that the end result of rehabilitation is employment."

WILL TO WIN

John M. Meiners, a GI-homesteader on the Roza Division of the Bureau of Reclamation's Yakima project in Washington State, walked through a lush field of green alfalfa, carrying part of a sprinkler system. A hay baler worked nearby. In the distance he could see his two small children playing on the front lawn of his home, and his wife picking vegetables in the garden. He paused for a moment, a satisfied expression on his face, as he took stock of his fortunes.

Small wonder the ex-infantryman should hesitate to count his blessings because only 6 years previous, when he was selected as the winner of this homestead, in 1947, the now lush fields were nothing but sagebrush and he was a 60-percent disabled veteran of World War II as a result of wounds from the push into the Po Valley of Italy.

John Meiners' success story is one of courage, perseverence, and vision. He was shot through the back and spent 7 months in the hospital at Baxter in Spokane. There he met an attractive girl, who, as a member of the Army Nurse Corps, helped nurse him back somewhere near to normal health. Two days after he was released, in 1945, they were married. "He got me by tripping me with his crutches," says Mrs. Meiners. "She doped me up so I couldn't defend myself," answers John.

Even though the aftereffects of the wound handicapped him—John has undergone 3 operations since he began farming, making 17 in all, and despite the 60-percent disability rating, he quickly removed the sagebrush, leveled the land, and brought the somewhat sandy soil into full production. In 1948 it was all in alfalfa.

He began building the house, at the same time sunk a well, planted shade trees, put in a lawn, built other buildings and raised a garden.

It wasn't always easy, but they never lost heart. "The wind blew something fierce," John reminisced. "Some of the alfalfa I had to plant two or three times, but we're glad we undertook it."

Today he has a comfortable home for his wife and two youngsters, Terry and Kathy, worth a

conservative $40,000, including land, equipment, etc., which he hopes to own outright pretty soon. Furthermore, they are earning a good living from the "place." And most important—they're a happy couple.

Year by year evidence accumulates and proves convincingly that it is good business to hire the handicapped. The performance of handicapped personnel on the Bureau of Reclamation's Denver offices payroll offers undeniable evidence to this effect.

Now working in the Bureau's Supply Field Division are two excellent cases in point. There are others, of course, but the two described prove the

A "product" of the homestead farm is 4-year-old Kathy, who is "helping" her father move the sprinkler system, above left. Kathy was 3 months old when the Meiners moved on the land. CONTRAST—Top photo shows Meiner's undeveloped land in 1947; photo immediately above shows same spot in 1953. *All photos by Stan Rasmussen, Region 1.*

paradox that physically impaired employees are sound employees, and may perform more satisfactorily than their nonhandicapped coworkers.

Joseph W. Flinn.

Joseph W. Flinn, a file clerk in the Communications and Records Section in the Denver Staff Offices of the Commissioner, has been a Federal employee since December 1946. He started as a messenger with the Veterans' Administration in Denver, and transferred to Reclamation's messenger rolls exactly 2 years later.

Undaunted by Parkinson's disease, contracted during his Army Service from 1943 to 1946, Joe did an outstanding job as a messenger. Because he is alert and conscientious, Joe was promoted in 1951 to a file clerk's position.

A tremor in his left arm and leg forces Joe to be more careful, particularly when he handles a large handful of file material. This enforced extra care may account for his superior performance in other aspects of the job. Supervisors' ratings show that he has outstanding work habits and attitude,

Allen C. Dunaway.

and indicate that he is more than adequate in such important qualities as skill in applying proper techniques and procedures, attention to pertinent detail, speed in completing assignments, cooperativeness, and dependability.

One of Joe's fellow employees, Allen C. Dunaway, lost his left leg at the hip while serving in the United States Army Air Force during World War II. Al is a microphotographer in the Communications and Records Section, and has been working for the Bureau continuously the last 7 years.

The fact that he has only one leg hinders him not at all in performing capably and satisfactorily with the photographic equipment he uses. Al processes Bureau records to be microfilmed, determining the best method and sequence in which material should be placed on the reels of film. He checks exposures to insure that there are no errors in recording. Also, Al maintains a card index of filmed records. He answers requests of other employees to see the material, and operates the projection equipment required.

Like Joe, Al has been more than satisfactory in his job. Ratings by his supervisors show that his skill, quality of work, dependability, and attention to detail are far above average.

Both Al and Joe are classed as "Disabled Veterans." However, it seems that such a label possibly is misleading. True, each made a great sacrifice for his country, and although Uncle Sam provides them some small advantage when applying for a job with him, they are paid only for full-time, productive work. Each earns his paycheck.

Kurt H. Pedersen, Engineering Aid, South Platte River District, Bureau of Reclamation, Denver, Colo., is another "Sound Business" example. Although badly handicapped by arthritis and the resulting crippling effects, he misses very few days from his drafting table where he turns out the drawings necessary to his department.

L. to R. Daniel K. Shepherd, Kurt H. Pedersen, and Denver B. Gimlin.

A veteran of World War I, Mr. Pedersen's present trouble seems to have started in 1931 when, working as a structural inspector, a scaffold collapsed and his back was fractured in the fall. During the ensuing years he has waged a determined fight against total disability, and now, although the fingers on both his hands are misshapen and stiff and he is forced to depend on crutches to get to and from his work, he produces good drawings, is very industrious, and at 58 years of age is studying engineering design—he refuses to stand still either physically or mentally. His fortitude in accepting this misfortune and his firm resolution to keep on working (which he says would have been impossible without the constant help and understanding of his wife), combined with health courses, vitamins, and constant exercise, have enabled him to continue to perform valuable and needed work.

Always cheerful, apparently never depressed, never complaining, but always looking on the bright side, Mr. Pedersen is an inspiration and example for all who may think they have misfortunes with which to cope.

Denver B. Gimlin, maintenance electrician at the Granby Pumping Plant of the Colorado-Big Thompson Project, follows the pattern. Mr. Gimlin's job involves work on equipment throughout the plant (equivalent to a 10-story building) and the many installations at dams, gates, high-voltage transmission switchyards, and other works in the Granby-Grand Lake area on the western slope. Heavy physical labor is not a requirement, but a great deal of active physical work is inherent in the job. Although Mr. Gimlin has his right leg amputated below the knee, he "gets around" in a completely adequate manner.

Daniel K. Shepherd, camp utility mechanic, Green Mountain Unit, Colorado-Big Thompson Project, makes the proverbial one-armed paperhanger look like a loafer. Despite his loss of one hand, Shepherd has accomplished prodigious tasks. He does the work of carpenter (seeing him drive a nail with only one hand is quite an experience) cabinetmaker, painter, bricklayer, rock mason, form builder for concrete, plumber and gardener. His supervisor claims that most jobs turned out by Shepherd are far better than the average turned out by persons not similarly handicapped.

An outstanding piece of work he has completed, with help only about half the time, is the construction of the boathouse at Green Mountain Reservoir. There are numerous other structures at Green Mountain camp, such as a utility shop, garage extension, room added to a house, concrete sidewalks, which testify as to Shepherd's ability and versatility.

These are only a few examples of how the handicapped, with THE WILL TO WIN, have helped themselves.

Purchasing Power of Reclamation

The Bureau of Reclamation has been paying back the Government's investment at gilt-edge security rates. When people of the West are able to raise their own standard of living and guarantee their purchasing power through stabilized irrigation agriculture, it means prosperity for them. But more important it means prosperity to the manufacturers and merchants of the entire country. They buy more and more consumer goods as their incomes increase. Proof of this vast purchasing power can be found in reports on the incoming and outgoing railroad shipments to a typical reclamation area during recent years. This area is the Ada and Canyon region of Idaho where the Boise project is located.

Approximately one-third of the volume and two-thirds of the value of all railroad shipments of freight into these counties were from the 37 States east of the Rocky Mountains. For every carload shipped out of the area one and one-half carloads were shipped into the area. Thus we see how the rest of the Nation benefits from newly created or expanded reclamation developments. #

New Map of Irrigated Lands

The Bureau of the Census has just completed a new map showing irrigated lands in the 17 Western States, Arkansas, and Florida. It is 34 x 41½ inches and may be purchased from the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C., for 35 cents.

"GET ACQUAINTED" COPIES

If you have friends or associates who would be interested in the Reclamation Era, please send their names and addresses to the Bureau of Reclamation, Washington 25, D. C. We shall be glad to send them copies of back issues.

RECLAMATION'S HALL OF FAME

Nomination No. 18

JOHN S. MOORE

On May 2, 1953, John S. Moore was laid to rest in Terrace Heights Memorial Park at Yakima, Wash. Death came to Mr. Moore at the age of 66, after having served 45 years as an engineer and administrator in the field of reclamation. Those who had known John Moore intimately, realized how fitting a tribute was spoken when at the funeral service he was described as "a great man of firm, yet kind and stalwart integrity."

Reclamation of the arid lands of the West was his life work, but into life were woven the finer characteristics of a true Christian gentleman, with a firm, but soft-spoken voice and a kindly disposition, which made him an understanding father, a successful engineer, an outstanding administrator and a sincere friend to all who came in contact with him.

He was born in Charleston, W. Va., October 4, 1886, and received a degree in Civil Engineering from Washington and Lee University in 1907. A year later the young engineer traveled West to take a position as Junior Engineer on the Minidoka Project in southern Idaho. The U. S. Reclamation Service was then only 6 years old.

In August 1908, young Moore was transferred to the Yakima Project, where he was assigned to the irrigation operations staff at Sunnyside, Wash. The project was then in its third year of Government operation, having been taken over from the Washington Irrigation Company in 1905. Managers and Superintendents of irrigation projects were, in those days, truly "grass roots" men who had to learn the hard way. John Moore was one of the pioneers who faced the challenge of those eventful years, and gave himself to a lifetime service as an Operation and Maintenance engineer and administrator, a service which few others have accomplished.

The old friends in Sunnyside knew John as "Bunny." How the nickname originated we are not certain, but it could have been that it was attached to him by Juanita Noble, the daughter of a pioneer Sunnyside farmer, who intently watched him chasing the jack rabbits from his path as he surveyed the flow-line contour along which the irrigation ditches were being constructed on her father's farm. Anyway, the nickname stuck as well as did the marriage in 1910 of Juanita (Nita)

Noble and John S. (Bunny) Moore. The Moore family has 6 children and 12 grandchildren. "Nita" needs no introduction to the Reclamation family because she is known to most of them as John's charming partner, who enjoyed life to the fullest and fitted into the picture upon all occasions.

In 1917 Moore was transferred to the Tieton Division of the Yakima Project to take over the responsibilities of Superintendent of Irrigation. Significant to the esteem with which the young Maintenance Engineer was regarded, is the statement of the Sunnyside Manager, who called the office group into conference and advised them that, since Mr. Moore was being transferred, it would be necessary for all of the remaining employees to take on considerably greater responsibilities, because they would no longer have the guidance of their former supervisor. He stated that few men possessed the keen judgment and administrative skill of Mr. Moore. They would miss him but were happy over his well deserved advancement.

His administrative abilities brought further advancement to the position of Superintendent of the entire Yakima Project in 1931, and ten years later he was transferred to Denver as Supervisor of Operations and Maintenance for the Bureau. The rigors of carrying on that responsibility during the second World War impaired his health so that he found it necessary to take on less arduous duties. In 1945 he moved to Boise where he served as Assistant to Regional Director Bob Newell. In that capacity John was Bob's intimate counselor in directing the expanding activities in Region 1, during and immediately following World War II.

After he recuperated, Mr. Newell asked Moore to take over the Superintendency of the Minidoka Project. There were some difficult administrative problems to handle on that project, so John Moore accepted the challenge. He served as Project Superintendent for about 2 years and retired in 1950, returning to Yakima to be near his family and lifelong friends.

Retirement from Government service simply meant greater freedom of action for Moore, but he took on other jobs. He became secretary of the Yakima Masonic Lodge, and was elected to the presidency of the Washington State Reclamation Association. The State Supervisor of Hydraulics also called upon him to serve as watermaster for the administration of water rights in the Yakima Valley. This latter job he thoroughly enjoyed as it kept him in touch with the irrigation farmers. He often spoke of it as his "Glorified Ditchrider" job.

Mrs. Moore speaks with great enthusiasm about a 53-day trip, made after their retirement, in which they circled the United States and visited 51 retired Reclamation employees. I am sure that those visited will recall the Moores with equal enthusiasm.

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Full And Supplemental Irrigation Service Land

The latest definitions for Full and Supplemental Irrigation Land have been incorporated in the Bureau of Reclamation's Manual.

For your information these definitions are:

*Full Irrigation Service Land** is irrigable land now receiving, or to receive, its sole and generally adequate irrigation supply through works or facilities constructed by or to be constructed by the Bureau of Reclamation. This term applies also to previously irrigated land in non-Federal projects where a substantial portion of the facilities has been, or is to be, constructed, rehabilitated or replaced by the Bureau.

*Supplemental Irrigation Service Lands** is irrigable land now receiving, or to receive, an additional or re-regulated supply of irrigation water through works or facilities constructed by or to be constructed by the Bureau of Reclamation. Such supply together with the supply from nonproject sources will generally constitute an adequate supply.

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* These definitions apply to any Bureau of Reclamation project, including those in the planning, development, and operation stages.

YOUR MAGAZINE

Are there particular types of articles which you would like to see in the ERA that we have not printed to date? If so, please let us know, and we shall do our best to comply with your wishes.

LOW COST IRRIGATION STRUCTURES

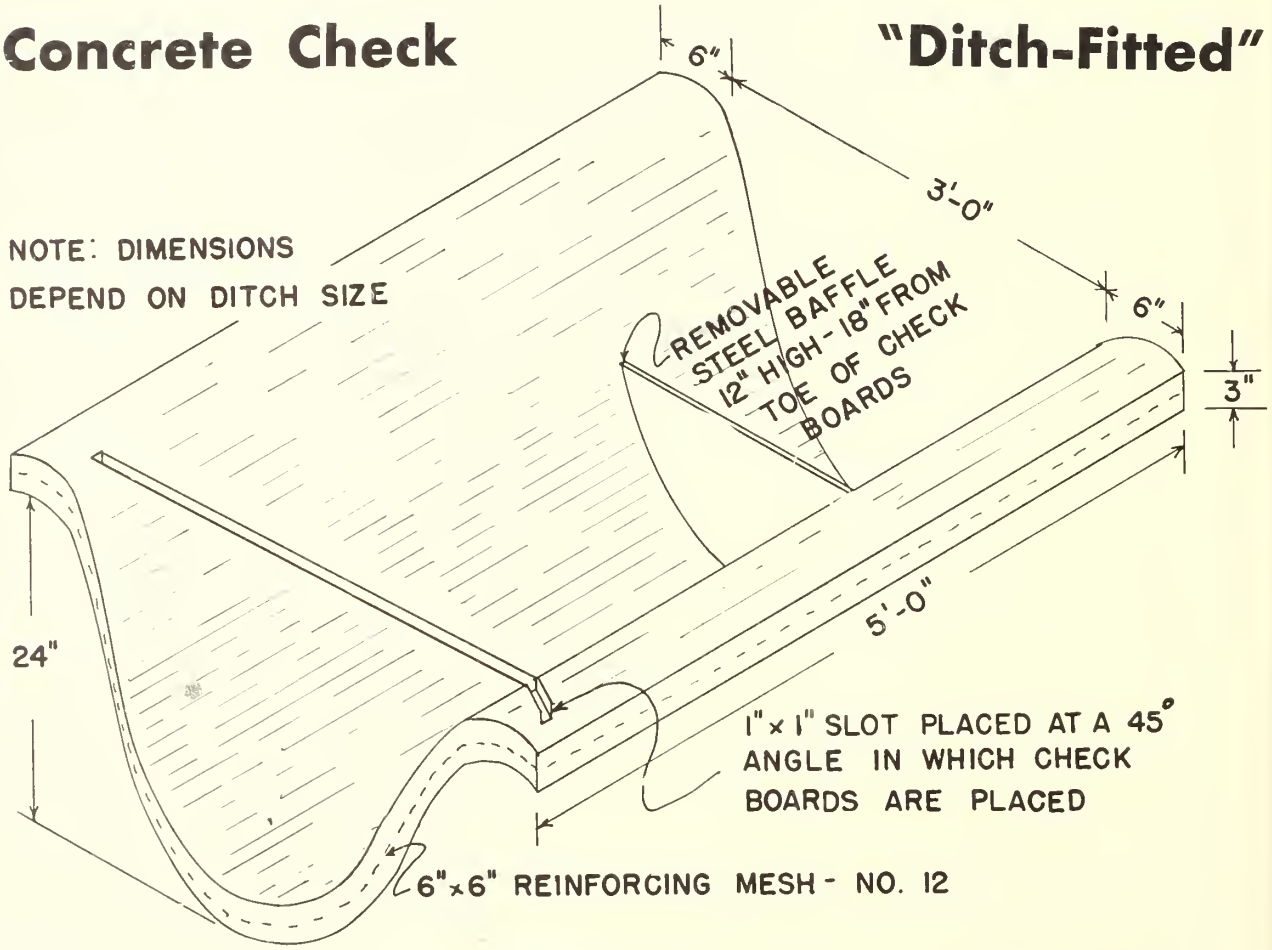
Third and last of a series of three articles based on information contained in Circular 122, a publication of the University of Wyoming, Extension Service

Permanent checks in your irrigation system can bring about vast savings in labor and can improve irrigating efficiency. Thanks to the efforts of irrigation engineers, permanent ditch-fitted checks have been developed which are durable and still permit use of ditch-cleaning equipment.

These checks, made of either concrete alone, concrete with concrete blocks, or wood, can maintain a constant water level in your ditch, permitting proper siphon irrigation—a feat often impossible with dirt dams.

One of the simplest is a concrete check formed to the contour of the ditch. By using a stiff mix, the concrete can be poured without using forms. A slot is then placed down both sides of the fresh concrete for check boards to slide into.

Another ditch-fitted check can be made of concrete blocks. Pour an 8-inch wide foundation across the bottom of the ditch and then at each end of this slab pour additional concrete to continue the foundation under each bank, these side sections to be placed at a 90° angle to the slope of the bank. Lay regular-sized concrete blocks up the side from the foundation, so that the face of the blocks will be flush with the face of the ditch bank from bottom to top. The blocks should have a 2- by 2-inch groove on their face to accommodate the check board, which is beveled on the ends to fit the slope of the grooved blocks. This check can be made simply and quickly with six concrete blocks and a few cubic feet of concrete. Besides being inexpensive and easy to install, this check allows ditch-cleaning equipment to pass through simply by lifting the nose of the ditcher.



To build another good permanent concrete-block check, pour a concrete foundation 8 inches wide and 4 inches thick across the bottom of the ditch and set the first blocks while the concrete is still fresh. The other blocks are set on top of the first blocks and the cored holes in the block filled with concrete, binding them firmly together. A spillway of concrete or rubble masonry can be placed at the toe to reduce the danger of soil erosion from the force of the stream. Grooved blocks provide a check-board slot in the opening. This structure is ideal as a combination check and drop. When used as a check alone, the spillway is sometimes left off the structure.

Another ditch-fitted check, which permits ready use of ditch-cleaning machinery, consists essentially of a pour of concrete, approximately 3 inches thick, covering the bottom and slopes of the ditch for a 5-foot length. The concrete is reinforced with 6- by 6-inch 12-gauge reinforcing mesh.

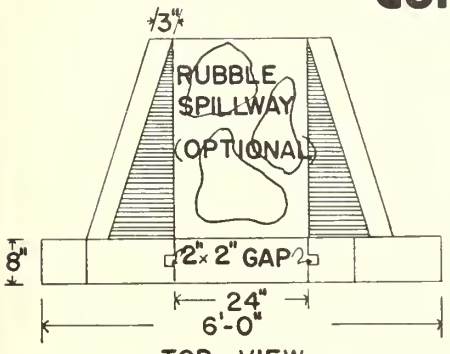
A 1- by 1-inch slot for the check board is placed in the fresh concrete, slanting down to the bottom of the ditch from the top at a 45° angle. If steel check boards are used, it is much easier to form the check slot and the danger of the check board floating is reduced. A vertical slot for a removable steel baffle is placed 18 inches down from the toe of the check board. The baffle, about 12 inches high, serves to break up the rapid flow of water.

A number of alternative structures—involving modifications of the above checks, made either of concrete, concrete blocks, or wood—can be improvised to meet specific farm needs and conditions.

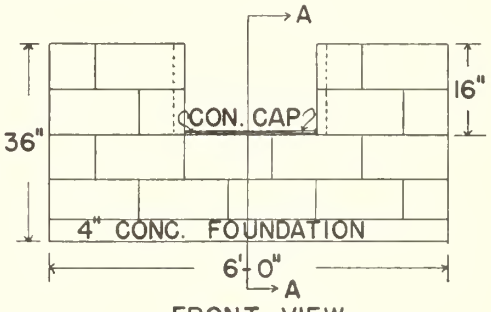
The Agricultural Extension Service of the University of Wyoming has recommended that, for best results, the following guides should generally be followed in the construction:

1. All concrete mixes should be 1–2¾–4 (ratio volumes of cement to sand to gravel), with a water-cement ratio of 5½ gallons per sack of cement.
2. Mortar mixes are 1–2½ masonry cement (ratio of volumes of cement and sand), or 1–1–5 for cement, hydrated lime, and sand mix.
3. All lumber should be preservative-treated.

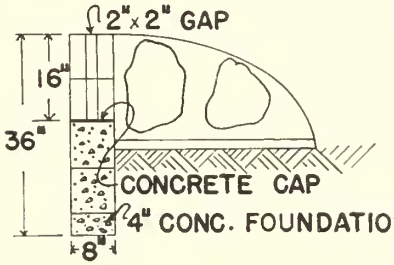
Concrete Block Check



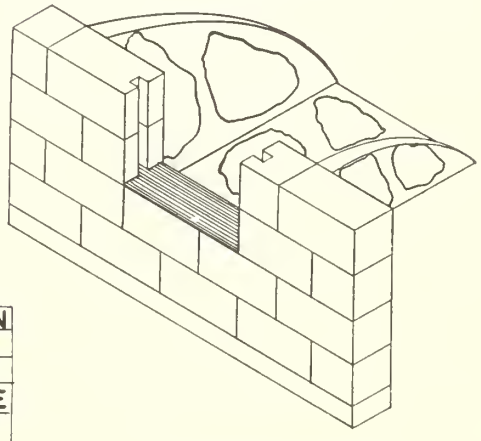
TOP VIEW



FRONT VIEW



SECTION A-A


ISOMETRIC VIEW

BILL OF MATERIALS

NO.	SIZE	DESCRIPTION
10	8"x8"x16"	REGULAR
4	8"x8"x8"	"
2	8"x8"x16"	2"x2" GROOVE
2	8"x8"x8"	" "
3 CU. FT. CONCRETE		

NEBRASKA LEGISLATORS HONORED—In appreciation for the splendid services rendered by Senator Hugh Butler (left photo) as Chairman of the Committee on Interior and Insular Affairs, U. S. Senate, and Hon. Dr. A. L. Miller (right photo) as Chairman of the Committee on Interior and Insular Affairs of the U. S. House of Representatives, recently the Nebraska Reclamation Association presented beautiful gavels and stands, with appropriate plaques, to both.

The bases were made of box elder, the stands of red cedar, and the gavels of hickory—all from native Nebraska trees cut from the University of Nebraska campus in 1893. The wood was contributed by Dr. George E. Condra, veteran director of the Conservation and Survey Division of the University of Nebraska. Through the courtesy of President Herbert L. Cushing of the Nebraska State Teachers College at Kearney, the gavels and stands were made by the Vocational Arts Division of that institution.

C. Petrus Peterson, President of the National Reclamation Association, made the presentation to Senator Butler at a committee meeting in the U. S. Senate committee room. William E. Welsh, Secretary-Manager of the National Reclamation Association, made the presentation to Dr. Miller during a hearing in the committee room, U. S. House of Representatives. Left photo by World Wide Photos, right by Glenn Peart, Interior Department.

Commissioner Dexheimer

Continued from page 153

the proposed billion dollar Snowy Mountains Hydroelectric Development and the Kiewa Hydroelectric Development in Australia. He has since made two trips as chairman of a board of engineers for further planning of the Snowy Mountains Project. He also served as the Bureau representative on construction of Falcon Dam, being built by the International Boundary and Water Commission under treaty with the Republic of Mexico. Early in 1953 he acted as chairman of a board of engineers to make a study of hydroelectric developments in Formosa for the Mutual Security Administration. He is a member of the American Society of Civil Engineers.

He is married to the former Johnnie Hadnot of Wellton, Ariz., and has one young son.

The appointment of Mr. Dexheimer as Commissioner was exceedingly well received throughout the Bureau and in the Western States where Reclamation operates. He is the second career employee of the Bureau to be promoted to a high post in the organization recently. The other was Clyde A. Spencer, Construction Engineer at Hungry Horse Dam, Mont., who was made Supervising Engineer of the California Projects with headquarters at Sacramento.

ADDITIONAL CHANGES IN RECLAMATION PERSONNEL

As this issue went to press, Commissioner Dexheimer announced the following changes in Reclamation personnel: The number of Assistant Commissioner positions was reduced from three to two. Assistant Commissioner Harvey F. McPhail will continue to serve as Assistant Commissioner. Assistant Commissioner Kenneth Markwell's position was abolished. Goodrich W. Lineweaver will become Assistant to Commissioner Dexheimer, advising on financial and legislative matters.

Floyd E. Dominy was appointed Director of Operation and Maintenance. E. D. Eaton will serve as Assistant Director of Operation and Maintenance. N. B. Bennett was named Director of Project Planning succeeding J. W. Dixon.

The Division of Management Planning was abolished, and some of the functions and personnel of that office will be transferred to the Division of Personnel temporarily. All changes are effective October 1.

LETTERS

"Investigate Before You Invest" Is Good Solid Information

RICHMOND, CALIF.,
May 12, 1953.

BUREAU OF RECLAMATION,
U. S. Department of Interior,
Washington 25, D. C.
Attn. Mr. J. J. McCarthy, Acting Editor
THE RECLAMATION ERA

DEAR MR. MCCARTHY: With high interest we have read subject article written by Claude H. Pair and L. R. Swarner.

We would appreciate very much hearing from you soon as to the availability of reprints of subject article, cost of same in quantities of 1,000, 2,000 or 3,000 if available, or if reprints are not available would you and the authors allow us to reprint same. If the latter please advise regulations which might apply.

We believe that this is the kind of information which should be placed into the hands of prospective purchasers all over the country and submit a copy of our small pamphlet "Plan Agricultural Sprinkler Irrigation" which we wrote and issued in 1948. We have issued several thousand of same in California since.

We hope and trust that somehow you will allow us to get this good solid information into the hands of several thousand more people with the authoritative ring of the names of the men who wrote this article.

Sincerely,
ALSCO, INC.
L. T. Slauson, Pres.

Our Appreciation to The American Society of Agronomy

MADISON, WIS.
July 24, 1953.

DEAR SIR: Thank you for your courtesy in sending us the information copies of the July 1953 issue of *Reclamation Era*, with the Diebold article. May I congratulate you on an all-around good looking issue. You really caught some of the beauty of the West in the Scottsbluff picture.

Sincerely yours,
[S] MAURICE R. HAAG,
Crops & Soils, The American Society of Agronomy.

Food Machinery & Chemical Corporation Finds It Helpful

SAN JOSE, CALIF.,
August 3, 1953.

GENTLEMEN: Our sprinkler irrigation department (Shur-Rane Systems) would like to order 6 copies of your June 1953 issue (*The Reclamation Era.*)

We think it is a wonderful magazine—our Shur-Rane department finds it especially interesting.

Yours very truly,
FOOD MACHINERY & CHEMICAL CORPORATION, *John Bean Division.*
[S] CONNIE DUCKWORTH,
Advertising Dept.

Reprints Requested

VISTA, CALIF.,
June 18, 1953.

DEAR SIR: Enclosed is a subscription to *The Reclamation Era.*

Please advise the availability of a reprint of the article by Mr. Corey in the June issue on page 116. We would like to obtain 500 copies of this or the permission to reprint for free distribution.

Yours very truly,
ROBERT H. WEHREN,
Business Manager,
Portable Aluminum Irrigation Co.,
Vista, Calif.

The article referred to was "Light, Frequent Irrigation Best" which describes the most economical and effective method of irrigation. Reprint permission was gladly granted.—Ed.

CROPS

1952 Record Year

For the first time in Reclamation history the gross crop value of a single Reclamation harvest neared the 1-billion-dollar mark during 1952.

The $935,679,755 crop constituted an increase of $113,958,090 over the previous year's $821,721,665 harvest, and marked the seventh consecutive year of crops grown on Reclamation projects at values in excess of a half-billion dollars. It is important to note that this increase occurred in a year when there was no material change in the overall index of crop prices from the previous year. The cumulative value of all Reclamation harvests through 1952 is more than $8.9 billion as compared with a total Federal investment in all Reclamation works of less than $2.2 billion as of June 30, 1952.

The harvest of 1952 was made up of 23,606,400 tons of food, forage, and fiber and was over 1½ million tons greater than the 1951 harvest. Of the total, 52.9 percent (12,484,619 tons) was in hay, pasture, forage, and cereal groups, 26.5 percent (6,268,744 tons) was in field crops and seeds, and 20.6 percent (4,853,054 tons) was in vegetables, truck, fruit, and nut groups. In terms of acres, the most significant crop group was hay and forage with 44 percent of all irrigated lands producing these crops. The 10,837,700-ton harvest of these crops contributed materially to the orderly use of the 700-million-acre western range.

The 1951 crop contained 4,674,267 tons of fruits, nuts, vegetables, and pulses. Production of these so-called protective foods increased in 1952 to 5,075,933 tons. (Figures for both years include dry beans which for other purposes are grouped under field and seed crops.) Thus, production in 1952 in this critical group increased by slightly over 400,000 tons.

The most significant individual crop produced in 1952 was cotton, which made up approximately 25 percent of total crop value and utilized about 11 percent of the irrigated land. Highest per acre values were reported on the Coachella Division of the Boulder Canyon Project and the Central Valley Project, both in California, where nearly 1,400 acres of fresh market tomatoes produced values in excess of $2,600 per acre.

The importance of crop specialties to the Reclamation farmer in 1952 is evidenced in the production of nearly 200,000 acres of crops with gross values of $500 per acre and over. In aggregate the value of these crop specialties was over $143.1 million, or $718 per acre.

Wide variation was again reported in 1952 in water requirements and deliveries with sharp differences reported between projects and in some instances between districts on the same project.

MAJOR CONTRACTS AWARDED DURING JUNE AND JULY 1953

Spec. No.	Project	Award date	Description of work or material	Contractor's name and address	Contract amount
DC-3915	Central Valley, Calif	June 4	Construction of earthwork and structures for laterals, sublaterals, and wasteways for north section of unit 1, Madera distribution system.	H. Earl Parker, Inc., Marysville, Calif.	$656,393
DS-3916	Yakima, Wash	June 22	One 11,200/14,000-kilovolt-ampere transformer with lightning arresters, current transformers for Chandler switchyard.	Central Transformer Corp., Pine Bluff, Ark.	56,920
DC-3923	Columbia Basin, Wash	June 12	Construction of earthwork, pipelines, and structures for area W-7 (block 78) laterals, sublaterals, and wasteways, West canal laterals.	Cherf Brothers Construction Co. and Roy F. Johnson and Sandkay Contractors, Inc., Ephrata, Wash.	391,170
DC-3926	Gila, Ariz	June 4	Construction of Water Users' administration building.	Arrow Construction Co., Inc., Yuma, Ariz.	91,591
DC-3934	Rio Grande, N. Mex	do	Construction of earthwork and structures for wasteway channels for Picacho Arroyo control.	Evans and Shaffer, Mesilla Park, N. Mex.	39,827
DC-3935	Middle Rio Grande, N. Mex	do	Construction of channel erosion control and surfacing access roads in Elephant Butte area.	Floyd Haake, Santa Fe, N. Mex	56,764
DC-3937	Palisades, Idaho	June 11	Construction of Snake River bridge superstructure for relocation of Wyoming state highway, U. S. 89, near Palisades reservoir.	LeBoeuf-Dougherty Contracting Co. and Erickson & Pierson, Richmond, Calif.	296,270
DC-3938	do	do	Construction of Snake River bridge substructure and roadway approach embankment for relocation of Wyoming state highway, U. S. 89, near Palisades Reservoir.	J. A. Jones Construction Co. and Charles H. Tompkins Co., Seattle, Wash.	176,580
DS-3941	Central Valley, Calif	June 23	4 vertical traveling water screens for unit 1, Delano-Earlimart irrigation district, Friant-Kern canal distribution system.	Link-Belt Co., San Francisco, Calif.	42,184
DC-3957	Boulder Canyon, Ariz.-Nev	do	Anchoring rock slab on canyon wall above Nevada valve house, Hoover Dam and powerplant.	Selby Drilling Corp., Los Angeles, Calif.	111,909
DS-3943	do	do	3 vertical-shaft, mixed-flow or propeller-type pumping units and thirteen vertical-shaft, turbine-type pumping units for lateral pumping plants, Plain View water district, Delta-Mendota canal distribution system.	Fairbanks, Morse & Co., Kansas City, Mo.	34,043
DC-3953	Colorado-Big Thompson, Colo	do	Construction of earthwork and structures for Boulder Creek supply canal with timber bridge decks, schedule 2.	Bales and Kite, Kansas City, Mo	972,077
DC-3954	Gila, Ariz	do	Construction of earthwork, concrete lining, and structures for Dome canal and Unit 1 of Dome distribution system.	Morrison-Knudsen Co., Inc., Los Angeles, Calif.	1,990,792
DC-3967	Missouri River Basin, Nebr	do	Construction of Enders dam auxiliary drainage	Claussen-Olson-Benner, Inc., Holdrege, Nebr.	27,580
DC-3977	Missouri River Basin, S. Dak	June 25	Drilling irrigation wells Nos. 1 and 2 near Tulare and Burdette, S. Dak.	Sterling Norbeck, Redfield, S. Dak.	12,776
DC-3940	Missouri River Basin, Nebr	July 16	Construction of earthwork and structures for laterals, sublaterals and chains for Cambridge Canal, station 1574-29 to station 2607-93.	Bushman Construction Co., St. Joseph, Mo.	1,224,616
DC-3942	do	do	Construction of earthwork and structures for Naponee Canal, station 0-00 to station 473-25 and lateral 2.1 and Franklin laterals 5.4 to 24, inclusive.	do	542,616
DS-3944	Gila, Ariz	do	Five motor-control switchgear cubicles for Wellton-Mohawk Pumping Plants No. 1, 2, and 3.	Westingbouse Electric Corp., Denver, Colo.	58,866
DC-3947	Columbia Basin, Wash	July 13	Earthwork, pipe lines and structures, area W-6B (Block 76) laterals, West Canal laterals.	Cherf Brothers Construction Co., Roy F. Johnson and Sand Kay Contractors, Inc., Ephrata, Wash.	512,541
DC-3950	Yakima, Wash	July 7	Construction of Chandler power and pumping plant and appurtenant works.	A. J. Cheff Construction Co., Seattle, Wash.	1,957,713
DS-3951	Fort Peek, N. Dak	July 6	Outdoor power transformer for Williston substation	Westinghouse Electric Corp., Denver, Colo.	233,979
DS-3955	Gila, Ariz	July 23	Pumping units 6 pumping plants, unit 1, Dome Distribution System.	Fairbanks, Morse & Co., Kansas City, Mo.	42,970
DS-3963	Palisades, Idaho	July 21	Two 19.67-foot by 28.03-foot fixed wheel fates for outlet and power tunnels at Palisades Dam and powerplant.	American Bridge Division, U. S. Steel Corp., Denver, Colo.	185,300
DC-3966	Rio Grande, N. Mex.-Tex	July 15	Furnishing materials and installing overhead ground wires on existing 115-kilovolt transmission lines.	Hoak Construction Co., Des Moines, Iowa.	422,385
DC-3972	Columbia Basin, Wash	July 16	Construction of earthwork, pipelines and structures, area P-9 laterals, PE-55 to PE-66, inclusive, sublaterals and wasteways, Potholes East Canal Laterals.	Osberg Construction Co., Seattle, Wash.	1,383,097
100C-167	Minidoka, North Side Pumping Division, Idaho.	July 21	Drilling 21 water supply wells	R. J. Strasser Drilling Co., Portland, Oreg.	91,886
110C-169	Snake River, Mountain Home Division, Idaho.	June 26	Drilling, casing and testing observation and test wells	Hardin & Co., Boise, Idaho	20,599
300C-58	Gila, Ariz	July 29	Land leveling and construction of farm laterals, and structures for Mesa Development Farm.	Rankin & Booth Constructors, Inc., Yuma, Ariz.	58,52
400C-41	Provo River, Utah	June 26	Earth lining, Weber-Provo Diversion Canal, station 180+00 to station 205+51.	Davis & Butler Construction Co., Salt Lake City, Utah.	28,305
601C-34	Shoshone, Wyo	June 25	Construction of open and closed drains	D. M. Manning, Hysham, Mont	52,935
605C-21	Buffalo Rapids, Mont	June 17	Earthwork and structures for open and closed drains	E. G. Perry & Son and Union Credit Co., Townsend, Mont.	142,025
617C-35	Riverton, Wyo	June 25	Construction of open and closed drains in North Pavillion and North Portal areas.	Sharrock & Pursel, Cooper, Wyo	44,791
700C-309	North Platte, Nebr	do	Construction of Brown's Canyon Dam	Ellis Construction Co., Golden, Colo.	25,073
704C-302	Colorado-Big Thompson, Colo	June 24	Renovation and modification of 69-kilovolt and 115-kilovolt transmission lines.	Malcolm W. Larson Construction Co., Denver, Colo.	48,184

U. S. GOVERNMENT PRINTING OFFICE : O—1953

Construction and Materials for which Bids Will Be Requested by November 1953*

Project	Description of work or material
Central Valley, Calif.	Construction of Camino conduit involves 5.5 miles of 48- and 36-inch reinforced concrete pipeline, cylinder and noncylinder, or alternative steel pipeline, and construction of 2,400 feet of 6-foot horseshoe-type concrete-lined tunnel, located near Placerville, Calif.
Do	Construction of north section of Madera distribution system's Unit 3, Part 2, requires 21 miles of laterals and sublaterals varying from 85 to 15 cubic feet per second capacity, including checks, drops, road crossings, turnouts, division boxes, irrigation pipe crossings, and siphons, located 8 miles northwest of Madera, Calif.
Do	Constructing five rock-fill and sheet-pile drops in Dry Creek and 7.5 miles of open lateral, including siphons, turnouts, and concrete control structures, for the rehabilitation of Dry Creek and lateral 24.2, 10 miles northwest of Madera, Calif.
Do	Construction of the distribution system for unit 3 of the Delano-Earlimart irrigation district, covering a gross area of about 16,800 acres, will include 52 miles of reinforced concrete pipeline of from 60 to 12 inches in diameter, high-head pumping plants, low-head recirculating pumping plants, equalizing reservoirs, valves, slide gates, metal surge stands, and miscellaneous metalwork and electrical controls, near Delano, Calif.
Columbia Basin, Wash.	Installation of 230/295-kilovolt autotransformer and associated electrical equipment in Grand Coulee switchyard.
Do	Construction of 10 miles of drains in lateral area W-3 (block 71), will consist of excavating unlined ditch varying from 15 to 5 cubic feet per second capacities with base width of 3 to 2 feet, and constructing concrete structures, including drain inlets and road crossings.
Do	Construction of area P-4 (block 13) laterals, sublaterals, and wasteways, varying from 2.8 to 3 cubic feet per second capacities. Work consists of excavating 45.3 miles of unlined laterals and wasteways with base widths of 2 to 16 feet, 14.5 miles of pipeline from 12- to 60-inch culvert and pressure pipe, concrete structures, including division boxes, checks, culverts, seven small pumping plants, and three bridges.
Do	Construction of 23 miles of unlined reach of 560 to 160 cubic feet per second capacity with 10- to 24-foot bottom width for West canal's fifth section, will include constructing three county road bridges, 22 check structures, and 77 turnout structures, and furnishing and installing manually and motor-operated radial gates and hoists.
Davis Dam, Ariz.	Furnish materials and construct 35 miles of 115-kilovolt wood-pole H-frame transmission lines, including overhead ground wire, from Saguaro steam plant to Oracle, and from Saguaro to ED-5 substation.
Do	Erecting steel structures, installing electrical equipment, and constructing concrete footings for Knob substation, 8 miles west of Yuma, Ariz.
Milk River, Mont.	Excavation, placing concrete, grouting and general repair to Fresno dam spillway apron, near Havre, Mont.
Missouri River Basin, Kans.	Completion of Webster Dam on the South Fork of the Solomon River about 1 mile downstream from Webster, Rooks County, Kans., will include the following work: (*a*) Completion of earth-fill dam 110 feet high and about 11,000 feet long at 30-foot wide crest. Upstream slope will have riprap protection. (Foundation of portions of dam is under construction.) (*b*) Construction of earth-fill dike on left abutment, 10 feet high and about 2,500 feet long at 30-foot wide crest.
Missouri River Basin, Kans.—Continued	(*c*) Construction of concrete outlet works consisting of an intake structure, a 220-foot long, 4.5 foot diameter conduit, a gate chamber, a 270-foot long, 8-foot horseshoe conduit with steel pipe, a control structure, stilling basin, and a riprap-protected outlet channel. (*d*) Construction of concrete spillway consisting of a crest structure 116 feet wide controlled by three radial gates 33.33 feet by 39.51 feet, a 658 foot long chute, stilling basin 264 feet wide by 130 feet long, and a riprap-protected outlet channel.
Missouri River Basin, Mont.	Construction of operation and maintenance camp near Toston, Mont., will include constructing basement for a house, moving and placing the house on its foundation, and installing necessary utilities; and construction of a 24- by 40-foot prefabricated metal or concrete block shop-garage.
Missouri River Basin, N. Dak.	Raising 0.5 mile of road and constructing a bridge over James River 10 miles north of Jamestown, N. Dak.; and raising 0.5 mile of road and raising the present steel-truss bridge over the James River 23 miles north of Jamestown. Quantities include 175,000 cubic yards of excavation, 112 thousand feet board measure of lumber, 2,500 linear feet of wood piling, 200 linear feet of steel piling, and 9,000 pounds of other metal work. Roads are to be surfaced with gravel.
Missouri River Basin, Wyo.	Construction of 12.5-kilovolt bay and installation of a zigzag connected 3-phase grounding transformer. Contractor will furnish steel for structures and Government will furnish grounding transformer, circuit breakers, disconnecting switches, and instrument transformers, near Lovell, Wyo.
Missouri River Basin, S. Dak.	Construction of temporary Oahe substation will include erecting Government-furnished structural steel for bus structures; installing three 230-kilovolt and one 115-kilovolt Government-furnished power circuit breakers; installing a 100,000-kilovolt-ampere, 230-kilovolt autotransformer bank as well as 230-kilovolt and 115-kilovolt air switches and miscellaneous related equipment such as relays and lightning arresters, all Government-furnished; constructing foundations; and furnishing and installing lighting and control circuits. In addition, about 1½ miles of temporary 230-kilovolt wood-pole transmission line will be required, all materials for which will be furnished by the contractor.
Palisades, Idaho-Wyo.	Construction of gaging stations near Alpine, Wyo.
Rio Grande, N. Mex.	Construction of Picacho South Dam, 5 miles northwest of Las Cruces, N. Mex. will consist of a compacted earthfill embankment that, including the riprapped emergency spillway at the right end, will be approximately 1,680 feet long, 15 feet wide at embankment crest, and 28 feet high at embankment maximum section. It will require about 90,000 cubic yards of fill materials taken from reservoir borrow areas. An uncontrolled outlet works will pass under the left end of the embankment, and will consist of small concrete intake and outlet structures, and 120 feet of 36-inch diameter concrete pipe.
Vermejo, N. Mex.	Rehabilitation of 67.5 miles of 10 to 150 cubic feet per second laterals 8 miles northwest of Maxwell, N. Mex., in the Vermejo Conservancy district. Work includes excavation for 15.5 miles of new, relocated, or enlarged laterals; removal of about 71 concrete, 35 wooden, and 7 corrugated metal pipe structures; construction of about 192 concrete and 7 timber structures that include drops, checks, turnouts, bridges, and road crossings; and placing riprap at 28 existing structures.
Yakima, Wash.	The 6.6 miles of 500 cubic feet per second capacity Chandler Main canal, division 1, and 0.6 mile, 435 cubic feet per second Kiowa wasteway to be constructed near Prosser, Wash., will be concrete-lined for 1 mile and unlined for the remainder.

*Subject to change.

United States Department of the Interior, Douglas McKay, Secretary

BUREAU OF RECLAMATION OFFICES

Washington Office: United States Department of the Interior, Bureau of Reclamation, Washington 25, D. C.

Commissioner's Staff

Commissioner	Wilbur A. Dexheimer
Assistant Commissioner	Harvey F. McPhail
Assistant Commissioner	
Assistant to the Commissioner—Engineering	T. W. Mermel
Chief Counsel	Edward W. Fisher
Chief Engineer and Director, Design and Construction Division, Denver, Colo.	L. N. McClellan
Director, Personnel Division	Glenn D. Thompson
Acting Foreign Activities Officer	Luther E. Cliffe
Comptroller	
Director, Operation and Maintenance Division	Floyd E. Dominy
Director, Power Utilization Division	Henry B. Taliaferro
Director, Project Planning Division	N. B. Bennett
Director, Programs and Finance Division	Alfred R. Golze
Director, Supply Division	S. W. Crosthwait
District Manager, Alaska District Office, Juneau, Alaska	R. W. Jennings

REGIONAL OFFICES

REGION 1: Harold T. Nelson, Regional Director, Box 937, Reclamation Building, Fairgrounds, Boise, Idaho.
REGION 3: E. G. Nielsen, Regional Director, Administration Building, Boulder City, Nev.
REGION 4: E. O. Larson, Regional Director, 32 Exchange Place, P. O. Box 360, Salt Lake City 10, Utah.
REGION 5: H. E. Robbins, Regional Director, P. O. Box 1609, Old Post Office Building, 7th and Taylor, Amarillo, Tex.
REGION 6: K. F. Vernon, Regional Director, 7th and Central, P. O. Box 2130, Billings, Mont.
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California Projects, Clyde H. Spencer, Supervising Engineer, Box 2511, Fulton and Marconi Avenues, Sacramento 11, Calif.